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In Collaboration with Rollins John and Rajinder Singh

Impact of Corporate Integrated Farm Solutions on Small Farmers: A Case Study of Bayer, Karnal, Haryana

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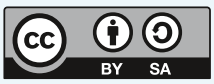

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Acknowledgements

This working paper presents the results of a collaborative project between Jawaharlal Nehru University and University of Kassel under the Global Partnership Network Programme between June and December 2021. The project was led by Archana Prasad, Praveen Jha, Dinesh Abrol, Christian Herzig and Tanja Verena Matheis. The Project Collaborators also included Rajinder Singh and Rollins John.

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Executive Summary

This study explores the penetration of agribusiness on the peasantry in a Karnal zone of Haryana, with a focus on input supply networks. It elaborates the ways in which big corporations, particularly transnational agribusiness, penetrate the markets and production systems through the promotion of 'integrated solutions'. The material basis of the establishment of corporate dominance through such solutions can be found in the emerging patterns of vertical and horizontal integration which are embedded within the macro political economy, marked by the ascendency of neoliberal economic reforms. The main motivation of the project was to understand how the power and control of transnational businesses is growing over the agricultural system in the context of persistent agrarian distress because of the changing role of the Indian State and its declining interventions in the agricultural sector. As this paper illustrates, neoliberal policies led the emergence of Global Agricultural Value Systems (GAVS), which were largely led by some of the biggest transnational corporations, with Bayer Crop Science being one of the four big players in the agro-chemical world market, especially after its merger with Monsanto in 2018.

In this context, the exploratory study unpacks the ways in which Bayer Crop Science was implementing its stated programme of 'integrated solutions', particularly in seeds and agro chemicals. It also provides some insights into the impact of these 'solutions' promoted by these corporates on all classes of farmers, particularly small and marginal farmers. In particular, the study focuses on impacts on cost of production, pesticide use, and environmental and occupational health. These themes are illustrated through field studies on paddy, vegetables and maize in the Karnal Zone comprising Karnal, Panipat and Kurukshetra districts.

As mentioned earlier, the exploratory field study focuses on documenting the material basis of corporate power by gaining insights into vertical and horizontal patterns of integration through case studies of paddy, vegetable and maize. Emerging impacts have been gauged through focus group discussions and a small field survey on the costs of production and use of agro chemicals. Both these methods have provided a broad understanding on the dynamics of corporate control over input supplies in local agrarian systems. Apart from the field studies, secondary data has been collected from national databases, and from the reports of companies. The company's own reporting was analysed from a social accounting perspective to understand the discursive strategy through which the company established its hegemony.

The main findings of the study can be summarised as follows:

- The use of the term 'integral farm solutions' refers to a combination of farm to fork services and products, that are marketed by transnational corporations as a result of the augmentation of their capacities through merger and acquisitions on the one hand, and inter-corporate alliances on the other hand. These patterns of vertical and horizontal integration indicate features that mark the current phase of development of the global agricultural value systems with systemic implications and impacts.
- One of the main findings of this study is that the trope of integrated solutions employed by Bayer has been able to enhance its hegemonic control over the agrarian system. The material basis of such control, is highlighted by mapping the impacts of the use of Bayer agro-chemical and seeds on cost of production, occupational health etc. The study found that the withdrawal of state subsidies has led to rising cost of production whose main drivers were sky rocketing agro-chemical prices in case of paddy, as also rising prices of seeds in the case of maize and vegetables. The most adverse impact of this has been on small and marginal farmers who are unable to offset the rising costs by either diversifying their operations or through ownership of assets.

- The indicative patterns of accumulation in three case studies highlight the absence of the state as a major factor in domination by companies. Input supply systems are embedded in corporate alliances between Bayer, and several international and domestic businesses, covering not only different inputs, but also marketing and processing of outputs. The case studies make explicit mention of these and show that the process of integration is geared towards the reduction of space of decision making for all farmers, especially marginal farmers (who work on leased lands) and small farmers. In this sense, the implementation of Bayer's market strategy has had an uneven impact, whose character is greatly influenced by existing power asymmetries within the agrarian society.
- The study illustrates how the withdrawal of the state from the agrarian sector has also led to the pesticide treadmill impact, despite the Bayer's claims that it promotes sustainable use of pesticides. However, the exploratory study indicates that the company has no infrastructure or system to monitor the use of pesticides and get feedback on their impact. Pesticides are not sold on prescription; they are sold through traders and commission agents. Though companies have contacts amongst farmers and in local areas, they do not invest in gathering any scientific feedback on their products, rather the findings give the impression that the effort is to increase the sales and usage of pesticides at all costs.
- The findings indicate the health and environmental impact of the treadmill effect, especially for small and marginal farmers and agricultural workers in this region. The lack of documentation of these dimensions is also highlighted by the analysis.
- Seen in this context, the promotion of sustainable 'integrated solutions' adopted by the Bayer, is the part of the company's hegemonic discourse, which reflects its dominant structural position in the world capitalist system. On the one hand the discourse is borne out of the capacity of Bayer to acquire firms (like Monsanto, Seminis etc) with complementary capacities. On the other hand, it shows its capacity to impact the market through strategic alliances with domestic and transnational players. Its power to forge these alliances is also a result of its structural position. Thus, the Bayer's 'discursive power' is embedded in the systemic relations that it forges through vertical and horizontal relations, indicating the greater penetration of GAVS.

1 Introduction

This paper explores the impact of penetration of corporate agribusinesses on the peasantry, particularly small and marginal farmers of Karnal zone situated in the heart of the green revolution region, which is commonly labelled as the granary of the Indian nation. As it happens, all the three districts of Karnal zone were actively involved in the recently suspended agitations against the 'anti-farmer black laws'. They achieved partial success with the repeal of the laws by the government, after a year of farmer's agitation. The ongoing struggle has highlighted that the challenges faced by regions wich have been the focus of the "green revolution", especially falling incomes from farming, growing indebtedness, and the rising costs of production (Singh, Bhangoo and Sharma 2019). As the latest official data show, incomes from cultivation have come down about 48 per cent of the income of the agricultural household in 2013 to 37.8 per cent in 2019. Further, average annual debts of agricultural households rose from about INR 47000 in 2013 to INR 74121 in 2019 (NSSO 2014, NSSO 2021), with more than half the households being in debt because of persistent agrarian distress since the mid-1990s. This scenario has been largely attributed to the ways in which farmers were affected by the penetration of domestic and transnational agribusinesses, supported by the Indian State's neoliberal policies (Singh, Singh and Dhanda 2021), which all classes of farmers have been resisting in the last few decades (Singh, Bhangoo and Sharma 2019).

The roots of persistent agrarian distress can be traced to the diminishing productivity and returns from the green revolution strategy since the mid-1980s, especially with respect to agricultural systems based on high external inputs (HEI). Such a cropping pattern has been characterized by the rice-wheat rotation system (Choudhary, et al. 2018). This trajectory of agricultural development led to the emergence of a class of large and middle farmers, the foundation of whose economic prosperity was State Capitalism. The State procured produce, provided cheap inputs and invested in agricultural infrastructure in order to meet its objective of food security through increased production of food grains. However, this strategy also led to accumulation and concentration of wealth through the exacerbation of land and income inequality (U. Patnaik 2007). These trends were coupled with external pressures (especially from agencies like the WTO), that led to a neoliberal policy response by the State (U. Patnaik 2003, U. Patnaik 1999) and created space for the consolidation of big business led agribusinesses in the region. The lack of response by the Indian state, and its adoption of the strategy of reforms has led to the creation of space for the dominance of big agribusiness. It also led to a policy shift, with the State no longer pursued food security as one of its major goals; rather it pushed for export-oriented agriculture which, would directly link farmers with the world market (U. Patnaik 2003, Abrol 2020, Jha and Yeros 2022, Clapp

and Fuchs 2009). The recently repealed farm laws are good illustrations for the ways in which market regulations are being changed in order to make space for big players (Rawal and Bansal 2019, Krishnamurthy 2021). This reasoning has informed the critics of neoliberal policies, who have increasingly pointed out the failure of the neoliberal state to address the persistent agrarian crisis.

In contrast, proponents of the reforms, (including a section of agricultural economists and international policymaking agencies) have attributed the persistent agrarian crisis to the problem of 'market failures' and 'government failures' (Bathla, Joshi and Kumar 2020, Gulati, Roy and Saini 2021, Chand 2019). They argue that state monopolies of procurement and lack of competition have resulted in lower incomes from farming. Hence, reforms were needed to augment investments in agriculture infrastructure, and to restructure input management to ensure ensuring efficiency and sustainability (Chand 2017). These reforms aimed to boost corporate investments in agricultural infrastructure, in order to acheive better price realization, and increased productivity through better input management. The solutions propagated by the State's own policies prioritize the growth of 'value chains' and export markets through holistic and integrated interventions. Emphasis has been put on technological and market-based solutions, on the assumption that increasing private investments will lead to crop diversification and better solutions for integration of agriculture with livestock management and fisheries (Ministry of Agriculture 2017).

The push to integrate India's agriculture with global markets in the current phase of neoliberal agrarian reforms has been shaped by pressure from international trade agreements and multilateral organizations, such as the WTO (U. Patnaik 1999, Heinrich Boll Stiftung 2017). And even though the above-mentioned policy trajectory is more than two decades old, the transformations in qualitative institutional and regulatory changes can be traced to the last decade (Jha and Prasad 2020). Successive changes have led to the withdrawal of the state from agricultural extension, research and development and related activities. This is done with the perspective of promoting the concept of 'One Nation, One Market', with the understanding that these policies will lead to better incomes for farmers through structural reforms which would lead to the integration of farmers into world markets. The process has been spearheaded, not only by transnational companies but also by domestic corporate agribusinesses, whose dependence on transnational corporations has increased over time, especially in terms of R&D and technological initiatives, which were earlier spearheaded by institutions of the state (Pray and Fuglie 2015, Lindstad 1999).

Such creation of space for corporate consolidation has impacted on both, backward and forward linkages in a manner which constricts the space for smallholder farmers to make independent decisions (Amanor 2019, Jha and Yeros 2019, Scherrer 2021, Laura, et al. 2020). Since these policy arrangements work in tandem with international trade agreements and multinational corporations, both governments and corporations influence farmers to intensify the production of crops that use inputs that are marketed by such corporations. For example, in 2018, worldwide global trade in seeds (67%) and agro chemicals (70%) was controlled by the top four transnational corporations (Mooney 2018, 8–9). Further, in recent times, market domination has not only been established through mergers and acquisitions, but also through inter-corporate alliances and the use of big data platforms (Mooney 2018). By doing this they affected patterns of vertical and horizontal integration (Jha and Yeros 2019), which have created new dependencies for farmers and led to an increased use of synthetic pesticides, in many parts of the world (Korthals 2018, John and Babu 2021).

This exploratory study provides insights into the ways in which agribusiness giants, particularly Bayer Crop Science, have promoted 'integrated solutions', in order to establish their control over the agricultural system in the villages of Karnal Zone (comprising the three districts of Karnal, Kurukshetra and Panipat). It shows that the trope of 'integrated solutions' is a hegemonic discourse whose material basis needs to be empirically unpacked through an investigation into the patterns of vertical and horizontal integration, arising through interventions of big agribusinesses in agricultural inputs, especially with respect three case studies on paddy, vegetables and maize. The study explores the local dynamics of corporate domination, particularly with reference to Bayer Crop Science and its agricultural inputs in the cultivation of paddy, vegetables and maize in the three districts of Karnal Zone.

The study also unpacks Bayer International and Bayer India's self-presentation of its own discourse on 'integrated solutions', provides some insights into corporate conduct. It also provides insights into the company reporting of the economic, occupational health and environmental impact domains by building on the findings available through field studies undertaken by the research team in Karnal. The critique of company reports is attempted through the method of social accounting (for example Shearer 2002, Ball and Osborne 2010, Bebbington, Unerman and O'Dwyer 2014). This technique brings out how the mechanisms of promotion of integrated solutions for use and the discourse carried out by Bayer International and Bayer Crop Science India allow transnational agribusiness to establish its hegemonic power worldwide over the farmers of green revolution areas of Haryana in India.

In its essence the study seeks context-specific answers to the following three questions: 1) In what manner do small farmers and agricultural workers get integrated into transnational agricultural input supply chains through the pursuit of "integrated farm solutions" of Bayer Crop Science in this region? 2) What are the impacts of such integration on peasants and agricultural workers, especially in terms of their costs of production, occupational health, and environmental impacts due to the overuse of pesticides? An exploration of these questions provides some preliminary insights on the dynamics of the emerging systemic impact of the transnationalisation of input supply systems, in the Indian case. It also provides some understanding of the strategies corporates use to consolidate their influence.

Sections 1.1 to 1.3 lay out the critical perspective on transnational capital and the reforms in Indian agriculture that served as a foundation for corporate control. Sections 2.1 to 2.2 make a study of Bayer's 'integrated solutions' and explore their overall expansion strategy through company and other reporting. Section 3 provides insights into the material basis of the discourse of 'integrated solutions' through an exploration of the emerging patterns of horizontal and vertical integration which result from interventions of multinationals like Bayer Crop Science and others in Karnal. Section 4 illustrates the material and discursive basis of corporate power counter posing corporate reporting with findings from the field, by exploring the contours of Bayer's hegemonic discourse and counter posing it with the findings of field study. It also summarises the findings from the investigation into the material basis of Bayer's growing power. Section 5 briefly outlines possibilities for further research.

1.1 Agrarian Transitions and Transnational Capital: A Critical Perspective

The intervention of transnational corporations in seeds, agro chemicals and machinery, is not a new phenomenon. In most countries of the South, the colonial period saw modest doses of agricultural investments by trans-national corporations from developed countries. Such investments facilitated the appropriation of 'cheap nature', largely as various raw materials, to facilitate the foundations of colonial capitalism (Patnaik and Patnaik 2021, Jha and Yeros 2022). Thereafter, some newly independent regimes like India, partly on account of the continuing pressures of peasant and agricultural worker movements, adopted several policy measures to ensure some autonomy from global capitalism, and these included a degree of protection for peasants, small farmers, and petty production. Almost all the countries in the South had shades of *dirigisme*, and depending on the timing of their independence, obtained national policy space in varying degrees to promote and protect different economic segments. However, with the ascendency of neoliberal regimes since the 1970s there has been considerable and sustained dismantling of whatever protection was available to petty production, in general, and agriculture in particular (Jha and Yeros 2019).

This shift has been marked by three macro structural transformations. First, neoliberal globalisation is largely driven by capital-as-finance and the growing financialisation of the global accumulation regime, with international finance capital playing an important role in policymaking and thus reducing the overall economic policy space, especially in the South (Jha and Yeros 2022). Second, significant developments leveraging foreign capital were innovations in transport and technology, which facilitated more centralised control by transnational capital and reconfigured relationships within supply chains (Jha and Yeros 2022). Further, developments in R&D and technologies have led to changing division of labour between the North and the South (Abrol 2020, Abrol 2020a), especially since the decline in public investments due to the weakening of the nation states in the erstwhile colonised countries. Third, the reorganisation of production has facilitated the relative unrestricted mobility of capital. Countries from the South got drawn into new patterns of production and trade, largely driven by the MNCs headquartered in North.

Relevant data from well-known major international institutions, such as the UNCTAD, OECD, WTO, ILO etc., report substantial acceleration and improvements in the share of 'global value chains'; for example, the UNCTAD reported that between 1995 and 2009. Incomes through the reorganization of production in 'global value chains' related trade increased by six-fold in China and five-fold in India. For developing countries as a whole, such trade contributed approximately 30% of GDP around 2010 and, as per the UNCTAD estimate, of the total global trade, more than 80% in 2013 (UNCTAD 2013). These structural transformations have resulted in the increased mobility of transnational capital and the decentring of production from the North to select locations of the South.; this has been facilitated through mergers and acquisitions; emerging alliances between domestic and international businesses and the reorganisation of labour within the countries of the South. The complex phenomenon that has emerged from this reorganisation has been variously termed as Global Value Chains (GVCs), Global Supply Chains (GSCs) and Global Production Networks (GPNs) (Gereffi and Fernandez-Stark 2016, Hess 2018, Herr and Dunhaupt 2019, Jha and Chakraborty 2014).

Literature on the GVCs and GSCs are mostly focused on explaining linear patterns of vertical integration from the lens of industrial governance, and rarely analyse the horizontal relations between different actors (Jha and Chakraborty 2014). GPN frame-work overcomes this gap through an attempt to capture the territorial organisation and its interlinked networks of multiple commodities and industries (Hess 2018, Yeung and Coe 2015). Though the use of the 'network' metaphor is more promising, it has at least one shortcoming: the GPN framework fails account for the appropriation of surplus from entities outside the circuit of production. In other words, it does not account for the patterns of accumulation within which the circuits of production are embedded. Such embeddedness arises out of asymmetrical power relations within the circuits of production as well as outside them through factors that are related to structural transformations in global capitalism. Such complex processes of surplus appropriation at different stages and levels of appropriation of surplus can be better captured through the conception of the Global Value Systems (Jha and Yeros 2019, Jha and Yeros 2022).

As mentioned earlier, the trope of the GVSs helps us to analyse vertical and horizontal arrangements within the circuits of production, as well as the power relations which structure the asymmetrical relations of control and exchange within vertical and horizontal relationships. The source of such power may result from structural transformations and institutional forms that predetermine the ability of big corporations to dominate circuits of production and exchange vis-à-vis domestic capital. This is particularly true when the power of corporations is derived from accumulation strategies which have resulted from oligopolistic market arrangements in global markets and enable them to set up subsidiaries in countries of the Global South, for expanding their networks (Scherrer 2021, Hymer 1979, Jha and Yeros 2022). Contemporary MNCs themselves have operationalised production hubs in different parts of the Global South, where low-value manufacturing structures the uneven exchange and value capture by transnational corporations (Suwandi 2019).

The structuring of such a system is possible because of the power asymmetries which influence the complex relationships between different actors, namely the transnational and domestic corporations and their subsidiaries, small firms, traders, and workers associated with a particular sector. The power to control subsidiaries and other dependent suppliers, by the headquarters of the transnational corporation, mostly headquartered in the North, is largely through mechanisms like the control of technology, evaluations of targets and control over the labour process through setting of standards (Suwandi 2019, Ietto-Gillies 2005). Such controlling power is relational, and is dependent upon the relative position of different actors within the capital-labour relationship (Poulantzas 1978, Jessop 2012), i.e., within the capitalist structure. This relational power is manifested in several different forms (Lukes 1974, Scherrer 2022, Fuchs 2005, Dallas, Ponte and Sturgeon 2019, Clapp and Fuchs 2009), in a complex of vertical and horizontal relationships that consolidate the position of the lead transnational corporation within the neoliberal global capitalist system.

The vertical relationships generally denote the hierarchy of actors, essentially to capture the underlying power relations, from the lead firms to the final producers such as farmers, peasants, and agricultural labourers, which result in the integration of different actors within the larger economic system that is dominated by transnational companies (TNCs). Horizontal relationships are essentially about the relationship between those who are on a similar footing or deal with similar goods and services (Jha and Yeros 2022, Jha and Yeros 2019). Their relationships are determined by the relative power of actors to influence policies, carry out R&D and innovation for developing new products, taking risks, establish their brands etc., for establishing their dominance over the market and existing competition. Here, TNCs may enter into alliances with others to increase their products and markets, in order to establish themselves. This leads to a lateral integration of domestic big and small businesses, within the network of transnational corporations. Such patterns of integration enable the restructuring of backward and forward linkages in a manner that leads to uneven distribution of risks and benefits (Balayan, et al. 2003). In both relationships, there is an unequal distribution of

benefits and appropriation of value depends, largely on the structural position of the actor within the larger system (Herr and Dunhaupt 2019, Nathan, Tiwari and Sarkar 2016). The trope of the GAVSs offers an opportunity to analyse the core dimensions of the asymmetrical and embedded relationship among the different actors' hinge around business / work / labour relations and distributional issues (Jha and Yeros 2019).

Within this broad framing we can see the emergence of Global Agricultural Value Systems (GAVSs) during the last half century or so. In the simplest sense, the GAVSs can be explained as arrangements involving a set of actors linked in a sequence of activities which add value in bringing / supplying a product from its raw material stage to the final consumer. Such actors range from large international and domestic companies, public and private research and development agencies, and trading and procurement agencies, on the one hand, to farmers, peasants and landless labourers, on the other. They are organized in terms of vertical and horizontal relationships, hinted at in the preceding discussion, where actors depend on each other to complete the production and marketing processes. Activities of such networks are facilitated by the government agricultural policies as also by the powerful international institutions, whose actions lead to *the ascendency of GAVSs, including the monopolistic concentration and control of resources, informalisation and marginalization of labour, acceleration of land alienation, loss of biodiversity, disappearance of livelihoods, and the weakening of food security in large parts of the South* (Jha and Yeros 2019). These vertical and horizontal relationships in the GAVSs are critical in influencing distributional outcomes as well as the conditions of working people, including their employment and wages, access to land, and the ecological challenges. The world of work for the majority of such producers consists of fragile and vulnerable conditions and the overwhelming majority makes a living through a collection of diverse economic activities, spanning agricultural and extractive activities, across rural and urban areas and even across international boundaries. One may, justifiably, quibble over fine-tuning of the relevant concepts, but it would be hardly off the mark to consider this large and heterogeneous segment as being co-terminus with Marx's relative surplus population (Jha and Yeros 2021).

Tendencies towards the cartelization of global markets in agricultural inputs and outputs have structured the development of GAVSs in the Global South, with corporations such as Syngenta, Bayer, Corteva, Nestle, ABF, Kraft etc. dominating markets (Mooney 2018, Heinrich Boll Stiftung 2017, Reardon and Timmer 2014). This industrialization of food and agriculture has contributed to an increase of direct land acquisitions and contract farming or outgrower arrangements models which differ from region to region given the diversity of agrarian systems and structures. In general, the multinationals, through their market share and command of resources, are able to control and influence the entire spectrum of activities and outcomes in the value systems, be it the provisioning of inputs, production and labour process or cost arrangements (Jha and Yeros 2019). The market concentration includes mergers and acquisitions in the upstream section (particularly knowledge- and cost-intensive research and development), as well as asymmetrical relationships with domestic businesses in all segments of the GAVs, including in agricultural inputs.

1.2 Neoliberal Reforms in Agriculture: A foundation for corporate control

Even though agribusinesses are not new to Indian agriculture, the growing domination of big agribusiness, particularly through headquarters are located in the North, is a relatively new development. The current inquiry into the impacts of input supply arrangements is built on an understanding that markets for farm inputs are politically instituted through state intervention and do not arise spontaneously. Deregulation and liberalisation of input markets is also subjected to this logic and has been influenced by the deregulation of markets for fertilisers, pesticides and external inputs. Neoliberal public policy reforms have also shifted the focus to export-oriented crops, thereby facilitating the loci of control of markets for farm inputs and output of agriculture to fractions of domestic and transnational capital in an accelerated way. Since the 2000s, such policies have led to a closer alliance between the State and agribusiness, where big domestic and transnational companies have influenced policies to consolidate and enhance their structural power (both economic and political), by influencing the character of neo-liberal reforms in agriculture, especially in the last decade.

In India, the withdrawal of the state from extension, R&D and marketing since 2000s, has led to the growing dominance of agribusiness's, especially in terms of their structural, institutional and relational[8], constitutive / discursive[9], and innovation / demonstration power[10], which have been studied by different scholars in case of global value systems (Dallas, Ponte and Sturgeon 2019, Fuchs 2005, Babic, Fichter and Heemskerk 2017, Kashwan, Maclean and Garcia-Lopez 2018). These forms of power are in turn embedded in the changing relationship between state and transnational capital. This is especially evident in the qualitatively transformed role of the state in the economic and technological realm in a qualitative way, and how with the weakening of the state promotion of R&D and innovation activity the ways in which corporate power can be consolidated and exercised through the promotion of corporate marketed inputs as is evident in the case of Bayer Crop Science. The expression of this consolidation is seen in systematic use of constitutive / discursive power, which is embedded in the growing structural power of Bayer and amplifies Bayer's hegemonic influence. The dialectical relationship between such forms of power and structural transformations deepens the processes of accumulation, that manifest themselves patterns of vertical and horizontal integration, affected by the interventions of Bayer Crop Science and other major transnational firms of foreign and domestic origin.

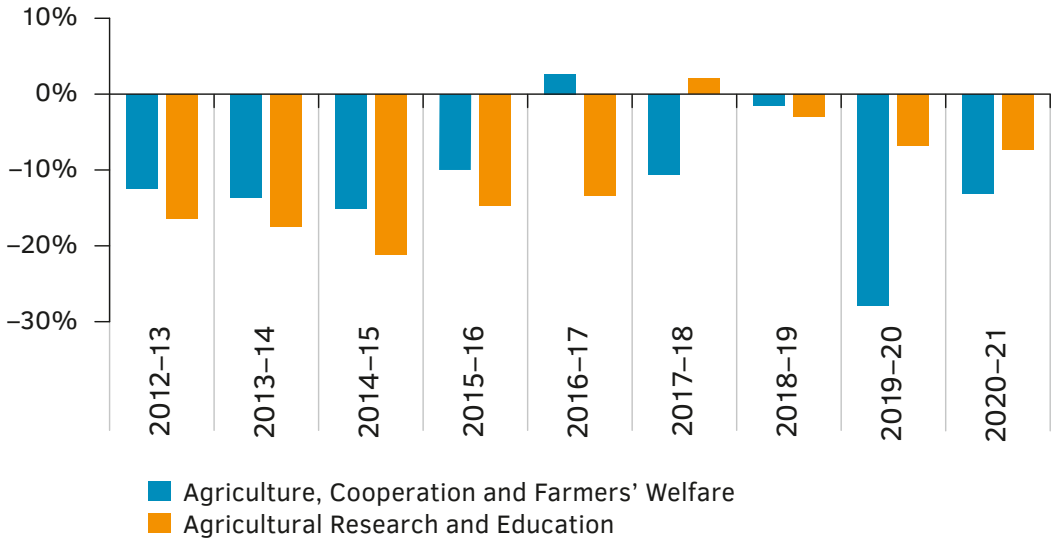
8 Actor control of regulative institutions, also exerted over the ones left out of certain political and policy agendas around a given sector. Institutional capture to meet one's own interests or policy beliefs, either transforming or reinforcing existing relations and structures is also important.

9 The broadest setting, where dominant views become established to secure public legitimacy, and wider political support, involves narratives that envelop the transformative & reinforce institutional work elements at play, frequently using public good framings (e.g. broad social, economic or environmental benefits, national interests.

10 Actor capacities to mobilize resources (e.g., capabilities, knowledge) in their own sector to directly pursue goals. Includes innovative power, such as the means to develop and experiment with technical innovations.

Persistent agrarian crisis in India is a sharp signifier of such a pattern of global integration; since the mid-1990s, when quantitative restrictions were removed from agricultural markets; close to half a million peasants have committed suicide since the mid-1990s (Singh, Bhangoo and Sharma 2019, Jha 2019). The contribution of agriculture to the overall GDP fell from 51% in 1951 to 19% in 2011 and further to 14.8% in 2019–2020. At the same time the 55% of the population continued to be dependent on agriculture for their livelihoods (PRS 2020, Jha and Prasad 2020). Second, there has been a significant decline in agriculture growth from the decade of the 1990s, and its cascading impact on labour absorption in the agricultural sector (Jha 2019, Kannan and Raveendran 2019, Rawal and Bansal 2019). Though the constraints of the green revolution strategy were evident from the mid-1980s onwards, the persistent depression in the sector has been largely policy driven and has been marked by a significant decline in public investment, in all aspects of agriculture and recent estimates from successive budgets show that the allocations in agriculture remained at 2–2.5% of the budgetary allocations between 2015–16 and 2019–2020 (CBGA 2021, 38). The marginal rise in allocations was largely due to the meagre income support programme started by the government of India, but in all areas of infrastructural investment the expenditure of both departments of agricultural cooperation and farmers welfare and agricultural research and education, declined drastically and was even less than the allocated budget, thus impacting the cost of production in significant ways.

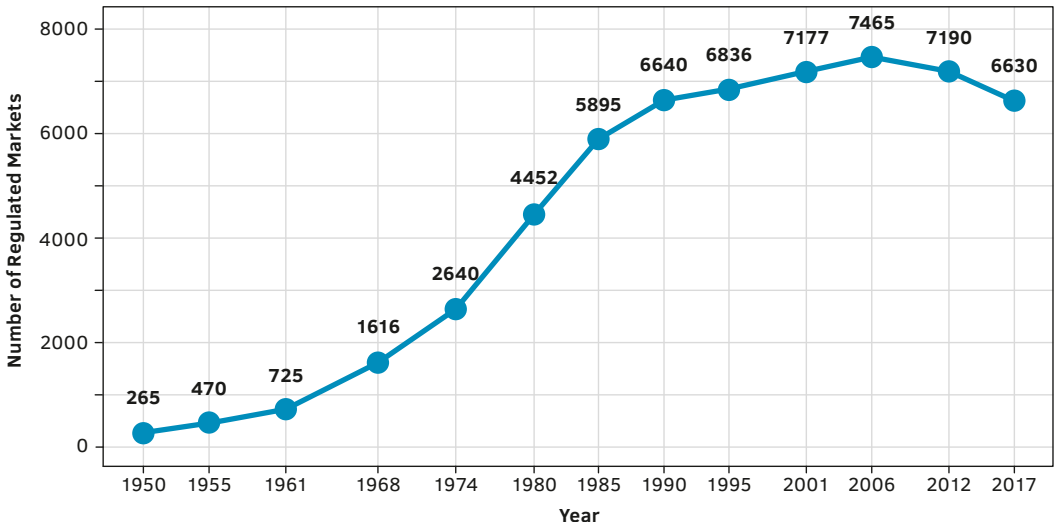
Figure 1.2.1: Trends in Actual Government Expenditure on Agriculture



Source: (PRS 2020)

Second, declining incomes were also a result on the increasing deregulation of agricultural markets and the APMCs through which the State procured the produce of farmers. This discouraged monopolistic practices and provided at least an assured price for some varieties, especially those being produced in green revolution regions. In the first four decades after independence, there was a rise in the number of regulated markets, (Figure 1.2.2) to just about 6630 regulated markets till 2017 under the Agricultural Produce Marketing Committee (APMC) Act. Decrease in the number of regulated markets had an adverse impact on procurement of food grains (with minimum support prices), by the State. By 2019–20, only 43% of the total production for rice, 36% for wheat, 12% for pulses and 1% for food were procured by the State (PRS 2020a). Further, as reported by the Parliamentary Committee on Food and Civil Supplies (Lok Sabha Aug 2021), there has been severe loss of food grains because of the lack of storage infrastructure, and the dependence on private players for agricultural infrastructure. Such a trend created the space for corporate led agribusinesses, both domestic and transnational (P. Patnaik 2020).This resulted in falling farm incomes (NSSO 2014, NSSO 2021) and greater dependence on contracts and wage labour (Jha and Prasad 2020).

Figure 1.2.2: Number of regulated markets in India



Source: (Rawal, Patel and Pais 2020, 15)

Third, the provisioning of cheap inputs for increased productivity was dependent on publicly funded R & D. The agricultural extension service provided both scientific advice, and certified inputs to farmers, at highly subsidized rates; the government provided crucial support to marginal and small landholders, and was a countervailing force against big private players. However, this underwent a significant change with the ascendancy of neoliberalism. While the core government funding remained more stable in ICAR[11] institutes (83.8%) than in state agricultural universities (SAUs), the share got reduced to 76.2% and had to undertake revenue generation to the extent of 23.8% (Shastry and Kumar 2016). There was a gradual decrease in research funding and national innovations, and this declining trend continues as shown in the recent data (Abrol 2020a)

Between 2019–2021, the budgetary support for crop sciences declined by 3%, for agricultural education by 28%, and by 14% for animal sciences. Support to central agricultural universities declined by 7% and to Indian Council of Agricultural Research by 3% in the same period; there was an overall reduction of support by 7% to the Department of Agricultural research and education (PRS 2020, Abrol 2020a). During 2018–2020, budgetary support to agricultural extension remained static at a mere INR 200 Crore (PRS 2020). Instead, National Agricultural Technology Program (NATP) both have large components devoted to developing research consortia with civil society and private partners encouraging private players to dominate R & D, and opening the door for trans-national foundations (Shastry and Kumar 2016).

This has also resulted in the withdrawal of the state as a countervailing force, thereby reducing the power of small players in the agricultural market. Further, growing power of transnational corporations in R & D was evidenced through the tie-ups between large multinationals and other private companies. Recent estimates of mergers and acquisition by the six big corporate giants in agro-pesticides and seeds, between 1996 and 2015, in 26 countries of the Global South reveal that around 406 companies have changed ownership with the aim of bringing about product and market integration, especially with respect to seeds and biopesticides (Abrol 2020). In India too, the process gathered momentum with the Bayer-Monsanto, and DuPont Dow mergers in 2018.

The mergers took place in a policy milieu where the Indian State chose to ignore the need of applying remedies which would compel these merged giants to share the rights to intellectual property with local Indian companies within reasonable prices, in order to maintain competition. Domestic companies were forced to fight their own battle for the domestic markets individually with these companies. While the Indian patent law has the provision to issue compulsory licenses, this provision is neither being invoked by local industry nor by government (Singh and Chakraborty 2019). This situation has given global giants a technological dominance and structured the power dynamics within markets for agricultural inputs.

11 ICAR is an acronym for Indian Council of Agricultural Research.

1.3 Market Concentrations, Mergers and their Impact on Patterns of Vertical Integration into GAVSs

As hinted earlier, the development of GAVS has also taken place because of the decentring of production into selected destinations of the Global South. Along with this, the deregulation by the State and its neoliberal policies have resulted the consolidation of corporate power, facilitating mega-mergers and market concentration[12] (Wigger and Buch-Hansen 2017, Mooney 2018). Transnational companies have developed a network of subsidiaries who carry out import and export operations amongst each other, a phenomenon that has been well studied by scholars of the past (Hymer 1979, Barnet and Muller 1974, Ietto-Gillies 2005). This has led to higher concentration and centralisation of capital, through the control over technology development, thereby accentuating the asymmetries between domestic and transnational capital[13].

Though public data on the development of GAVS is hard to access, the preliminary analysis from port level data show that the 'big four' seed and agro-chemical input companies created hubs of production, often through their subsidiaries. These subsidiaries imported Active Ingredients and technical formulations from the lead firm, and sold finished products to other subsidiaries in the region. For example, the Indian subsidiaries of Bayer Crop Science imported technical formulations and Active Ingredients from Bayer AG, Germany, Bayer USA and Bayer SAS France; similarly, Sygenta and Dow subsidiaries also imported technical and finished goods from their own related parties in Korea, China and US. In terms of export, Bayer Vapi and Bayer Crop Science exported products and formulations to other Bayer com-

12 There can be many interpretations of mergers and market concentration. In order to assess the consequences of market concentration, especially for society at large, there are two perspectives regulation authorities can assume. The narrower focus is an economic interpretation, in which authorities analyse whether increased concentration results in higher product prices for the customers, in that case, farmers, reduced innovation and reduced number of choices (OECD 2018). Proponents argue that pooling research and development resources allows better coordination and thus improve and encourage innovation in inputs (OECD 2018). To complicate things, higher concentration may not mean less price competition because oligopolies can engage in fierce price competition (Wigger and Buch-Hansen 2017). The stance by the European Commission and other competition authorities seems to be that narrow one because the number of unconditionally approved mergers has increased between 1990 and 2016, and the number of prohibited and conditionally approved mergers has stayed at a stagnantly low level (Wigger and Buch-Hansen 2017). In the same period, EU cartel fines imposed on companies rose sharply, indicating a preferential treatment of events of permanent concentration (mergers, acquisitions) as compared to events of temporary concentration (cartels) (Wigger and Buch-Hansen 2017).

13 In recent years, the trend of global pesticide development has seen some major shifts on account of technological change including shift from chemical to biological pesticides, shift to GM seeds, RNAi pesticides, and abiotic stress control agents. These technologies are also now under the control of big three in the case of agricultural input industry. The research and advisory firm Lux Research in Boston, MA, USA, predicts that bio-pesticides will equal synthetic (chemical) pesticides in terms of market size by the late 2040s or early 2050s.

panies in South Asia; this was also true of the other big transnational conglomerates[14]. The subsidiaries interacted with each other, not merely in terms of dealing in imports and exports, but also by paying royalty and professional fees to their mother companies: is can be seen in the data available for the pre-merger phase of companies dealing with agricultural inputs, particularly seeds and agro chemicals. Accompanying tables and graphs for this section in Annexure 3, show that for Indian subsidiaries, Forex earnings mainly take place in terms of exports (Graph 1.3.1 Annexure 3), whereas the spendings take place in terms of imports of raw materials, finished goods, royalties and professional fees, and other spending (Graph 1.3.2, 1.3.3, 1.3.4, Annexure 3). The trends of such spending between 1999 and 2017 show that Forex spending exceeds Forex earnings:

Table 1.3.1: Difference Between Forex Earning and Forex Spending of Indian Subsidiaries

	1994–1999	2000–2005	2006–2011	2012–2017
BAYER	–347.4	–470	–5820.6	–18437.5
DOW	–414.3	–2180	0	–27587.2
DUPONT	–181	0	0	0
MAHYCO	0	–53.7	–21.3	0
MONSANTO	0	–49	–3219.7	–4703.3

Source: (Abrol 2020)

The picture presented above illustrates that, at a macro level, the nation is becoming dependent on imported Active Ingredients (AIs), with respect to the production and consumption of pesticides. Bayer, Syngenta, Dupont and BASF increasingly import AIs and formulations than ever before. Pesticide-induced environmental, economic, social, and health consequences are going to persist due to the pesticide dependence and overuse and import dependence (Annexure 1). Few studies are available on the connections of changing input supply arrangements to the relations of production and resource use in the context of coevolving impediments to delinking of the farmers from high external input use and export orientation agriculture. However, despite such a scholarly gap, scholars also recognise, that in countries which had earlier focused on domestic market and food security, neoliberal reforms have created favourable conditions for the vertical integration in a sector where the country was technologically self-reliant prior to 2000s (Mrinalini and Sandhya 1996). Growing import dependence and emerging GAVSs in the input sector have resulted in the problem of foreign exchange outflow in pesticide and seed supply networks. Its consequences are reflected in the underdevelopment of R&D and production facilities and the associated problem of

14 This tendency can be surmised from the ongoing analysis of port-wise trade data between companies which is compiled by different companies like Exim Pulse, Sea Air and others. However, we need not go into the analysis of this data here.

foreign exchange outflow. Such outflow has also been termed as a 'drain' of resources, which characterizes the integration of domestic capital within the global political economy (Abrol 2020, Patnaik and Patnaik 2021).

Import dependence with respect to changing input supply arrangements in the post-liberalization period[15], which has adverse implications for farmers[16], is an understudied area of research. The firms dominating the agricultural input sector are now larger and command even more market share[17]. The ability of firms to raise prices without associated increases in quality or service is potentially much higher in markets with higher concentration. Over the past twenty years, the many transnational and domestic corporate giants have been to capture seed and chemical technologies which are protected by patents and have functioned as powerful barriers to entry. The firms that dominate in the sector are collaborating with one another on their seed and chemical research activities through a series of cross-licensing and collaboration agreements, which also makes it difficult for new players to break into the market. The nation states could have intervened at the time of megamergers in the agro-food sector. Since the 2000s all over the world competition laws were changed to facilitate the hold of corporates and not much could be achieved by the competition authorities to contain the market power of these companies in the Global South. The foreign exchange outflow, illustrated in preceding paragraphs, has resulted in the extraction of greater surplus by the

15 The influence of companies on neoliberal policies has also been pointed out by several scholars outside India also. A broader perspective is provided by the societal and political implications of increasing corporate concentration. The points of criticism include the influence large companies can take on regulatory processes (Clapp 2021), their ability to benefit from preferential taxation and loopholes in taxation (Trautvetter and Redeker 2021), the inadequacy of antitrust law to duly meet the challenges that come with platform companies which also control tremendous amounts of data (Khan and Vaheesan 2017), and their influence in preferential trade agreements (resource). In addition, the fact that market concentration also applies to the production and sales of seeds, the patenting of seed varieties represents another point of criticism as it prevents access to seeds and discourages from safeguarding and using varieties owned by producers.

16 The consequences of corporate concentration are documented for the farmers of so-called high-income countries (OECD 2018, Diez, Leigh and Tambunlertchai 2018, 13, Torshizi and Clapp 2021, J. Clapp 2019, 620). In the period 1998-2002, the agrochemical industry experienced a process of significantly high concentration and consolidation as the ten major research and development companies merged to create six (Monsanto, Syngenta, Bayer Crop Science, Dupont, Dow AgroSciences and BASF), each with total sales of over Euro 5 million in 2014. Since 2016 the global agricultural input sector has been impacted by a new round of megamergers through which vertical and horizontal consolidation takes place (Ioannis and Katalevsky 2017, Kalaitzandonakes and Zahringer 2018, Nacke 2018)).

17 By the end of 2017, the big six have become the big four: ChemChina and Syngenta controlling 24 per cent, Bayer and Monsanto controlling 23 per cent, Dupont and Dow controlling 11 per cent and BASF controlling 12 per cent. Four corporations controlling two-thirds of market power associated with rising inter-dependence and collaborative activity and common ownership, has the consequences with regard to broader societal outcomes. The global commercial seed market includes also now Monsanto-Bayer, Dow-Dupont, ChemChina-Syngenta and Vilmorin (owned by Lima grain). The top farm machinery companies are Deere & company (USA); Kubota (Japan); CNH Industrial (UK / Netherlands); AGCO (USA); CLAAS (Germany), and; Mahindra & Mahindra (India).

Bayer and Monsanto combine through extraction of royalty and dividend payments, tied imports and growing technological services dependence. There is a greater reliance on the AI imports. Global integration of the foreign sources of AIs is reflected in the list of sources approved for the purpose of import of technical for the purpose of formulation of pesticides chosen for sale in the Indian market (see Annexure 1). In this sense, the tendency of hollowing out of manufacturing and R & D continues to be accelerated in the sector, and one can expect this problem to become more acute. This is reflected in our case study on Bayer Crop Science.

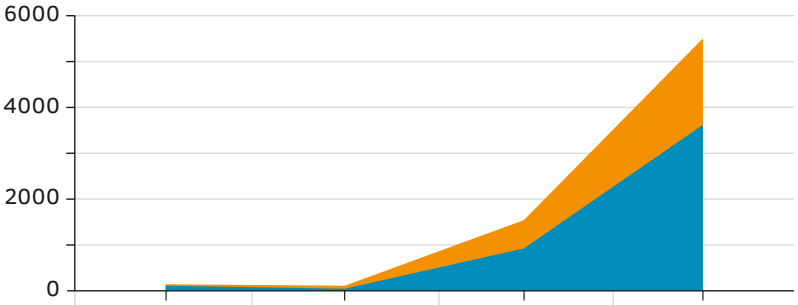
2 'Integrated Solutions' and the Growing Power of Bayer Crop Science

Bayer's decision to merge with Monsanto was driven by the opportunity which arose due to the promotion of data-driven industrial agriculture. Such mergers were expected to bring about a synergy in complementary capabilities between the two companies and lead to huge market concentration as pointed out by the proceedings of the Competition Commission of India (CCI). It was also noted by the CCI that Bayer, Syngenta, Monsanto, BASF and Dupont Dow were few of the select companies that had the capacity to do 'integrated R & D' and mergers of these companies with each other would eliminate competition, especially with respect to the discovery of new Active Ingredients and traits. This would also result in the domination of these companies across the 'value chain' (Competition Commission of India 2018a). In order to maintain the competition for new products, the CCI took an undertaking from Bayer, that it would not develop GM because the merger would enhance control over traits and result in dominance in genetically modified and hybrid seed business, as well as impact on farmers choices and agricultural biodiversity (Competition Commission of India 2018).These concerns had been backed up by studies from the Farmers Business Network, which had represented a positive correlation between a company's market share and its seed price. The consolidation of the market in agricultural input sector had led the farmers to take note of the implications on their incomes and cost of production (AIKS 2018).

In India, interventions in "Bt Cotton" was already under intense scrutiny from societal actors, especially, social and political movements, at the time of Bayer-Monsanto merger. In the past, the conduct of Bayer and Monsanto (MB) combine had come under public scrutiny when the chain of linked products brought in, like herbicide tolerant GMOs, for instance, where along with seeds, an associated proprietary herbicide is also marketed by the same entity, were seen as causing negative environmental and economic impacts (ECCHR 2015). More generally, the conduct of this combine received much public attention at the time of the Competition Commission of India's (CCI) scrutiny of the impact of megamergers on the corporate control. Even while the CCI gave approval to the Bayer Monsanto merger, it recommended that the Government of India monitor the conduct of the combine on a regular basis (Competition Commission of India 2018).

While making this recommendation, the CCI explicitly took note of the main grounds that were articulated by civil society actors at the global level: (a) High market concentration (just 3 corporations would own and sell about 64% of the world's pesticides / herbicides and 60% of the world's patented seeds); (b) Entrenched market power (a large number of patents being held by Bayer and Monsanto); (c) Increased prices (due to collusive pricing between small set of market players) and reduced choices for farmers; (d) Locking farmers in (how farmers would be locked into a value chain of products including digital farming and other IT platforms) and (e) reduced competition and innovation. These impacts resulted in drain of surplus from India to the North with Bayer and other transnational companies being the main beneficiaries from import dependence and pesticide trap (Hu 2020).

Figure 2.1: Forex Transanctions by Bayer Subsidiaries (In Rs Million)



	1994–1999	2000–2005	2006–2011	2012–2017
Bayer Total Forex Earnings	811,2	460,4	9150,9	35779,3
Bayer Total Forex Spendings	1158,6	930,4	14971,5	54216,8

(Source: CMIE PROWESS DATABASE)

The report of the CCI pointed out that with diminished competition, farmers who do not have their own seeds saved will be dependent on these corporations and their cost of cultivation is likely to rise significantly. This has implications for indebtedness as well as farmer suicides associated with increased debt burden due to increasing cost of cultivation, and low prices for their output. The lack of choices will also have serious environmental ramifications and result in mono-cropping. Further, lack of choices for farmers will also mean lack of choices for consumers. Increased cost of cultivation for farmers could also translate into increased food prices for consumers. The CCI pointed out that in the submissions of companies had only considered the downstream market for sale in the case of paddy and basmati rice seeds, and that Mahyco's market also needed to be considered while calculating market concentration (Competition Commission of India 2018).

Petitions to the Competition Commission pointed out that it is worthwhile for the CCI to investigate into the huge share of 40-45% in the rice hybrid seeds segment for Bayer and implications for competition, even without the proposal for merger. In Maize / Corn, CCI was asked to look at Monsanto's edge with regard to upstream market for corn transgenic traits / technology given that its products are in an advanced stage in the regulatory pipeline with the Government of India's Genetic Engineering Appraisal Committee (GEAC) (Alliance for Sustainable and Holistic Agriculture 2017). The petition pointed out that farmers had shifted to hybrid corn cultivation because of devious large-scale programmes initiated by big Monsanto (like Project Sunshine, Project Golden Rays etc.) in partnership with state governments. This forced farmers to become dependent on external seed sources by luring them into hybrid corn cultivation (Elmore 2021).

In the case of vegetables, there was discussion on the open pollinated varieties (OPVs) and hybrids under introduction by Bayer, Monsanto and Seminis. Attention was drawn to the fact that monopoly was already present for the Bayer and Monsanto, even if they were not considered as a combine, in vegetables like cabbage, cauliflower, bitter gourd, okra, hot pepper, tomato, watermelon etc. The share of these companies was significantly higher than that of their closest competitors, and the proportion would only grow if the share of Mahyco was also combined with theirs. It was pointed that there would be significant appreciable adverse impact on competition (AAEC) in the hybrid seed market in vegetables, given the already large shares of both these companies Bayer and Monsanto in this market. In the case of seed treatment products, attention was drawn to the growing dominance of Bayer across different crops like Paddy, Cotton and Corn (Competition Commission of India 2018a).

Our analysis of the proceedings of the merger, and its contestations, show how the mergers lead to cartelization of product markets taking place through the advancement of vertical and horizontal integration arrangements. The CCI orders illustrated, in detail, how the merged Bayer-Monsanto company would result in the domination of the market through horizontal integration of their R & D capabilities and lead to stifling of the capabilities of domestic firms.

In such a case these domestic firms would be more prone to emulation as they would not have competing capabilities. This would result in the augmentation of power, which could also be consolidated through the collaboration and alliance between firms. Here it is important to emphasise that the ability of Bayer to carry out the merger on favourable terms was influenced by its preeminent structural position and led to the deepening of existing power asymmetries, because of the policies of the neoliberal State, particularly in terms of deregulation and disinvestment in publicly funded R&D. This led to the enhancement of 'discursive power', which these companies acquired with the active support of advanced capitalist countries through influence in multilateral organisations such as the WTO, World Bank and IMF and other such international bodies. Bayer's discourse of 'integrated solutions' needs to be contextualised within this macro scenario.

2.1 Horizontal and vertical integration through "Food chain partnership" and "Science for a better life" programs

An analysis of the information provided by Bayer Crop Science, India, website and its Annual Reports reveal that the company promotes 'integrated solutions' as a "sustainable partnership model", involving all the relevant corporate stakeholders in the providing solutions covering the whole production process[18]. In theory, farmers are targeted in order to improve the overall profitability of their farms; companies project that improvements in quality and productivity that lead to better prices for produce, and therefore, the income of farmers will get higher incomes. As corporate reports argue, these solutions are not only linked to the goals of higher yields and higher product quality, but also to aspirations of 'higher farm incomes', 'food security', 'job creation' and 'smallholder empowerment', of which there are many references especially in the reports of Bayer's Indian subsidiary. This focus on "smallholder farming" in so-called emerging economies has become more pronounced since the start of the multinational's global initiative in 2015. The initiative became more formalized as "Better Life Farming" alliance, launched in India in 2018, including the International Finance Corporation (IFC, a member of the World Bank Group), an irrigation company, a global insurance company, an Indian fertilizer company, an Indian online marketplace for agricultural inputs, and an Indian online supermarket (Bayer Crop Science India 2019, 5). The initiative also arguably supports so called "Better Life Farming Centres run by local agri-entrepreneurs" which claim to create a focal point for smallholders for "knowledge and technology transfer" and the provision of agricultural inputs and financial services (Bayer Crop Science India 2021, 7). By the end of 2021, the company envisaged an increase from 710 to 1,500 of such centres in collaboration with government promoted farmer producer organizations (FPOs) in India.

18 In its own words, the Bayer's Indian subsidiary provides a "total package solution from 'seed to harvest' in key agriculture and horticulture crops" ((Bayer Crop Science India 2021, 49)

However, our analysis shows that the integration of solutions takes place at firm level and do not incorporate any elements of the local society that the Bayer hopes to transform through these partnerships. In this sense, the interface between packages and farmers only takes place at the point of sale. Although all the solutions, be they for rice or vegetables or maize, involve the use of pesticides based integrated solutions, (involving proprietary as well as non-proprietary products of Bayer and Monsanto (MB) combine), the claim is that knowledge management is according to Good Agricultural Practices (GAP). These comprise of elements that include: advice to farmers on using top-quality seeds, optimum use of plant protection products and fertilizers, professional project monitoring, implementation of product stewardship measures to ensure the safe use of plant protection products, post-harvest support and the knowledge of downstream quality parameters for healthy and nutritious produce.

It appears from the desk research that integrated farm solutions in the case of Bayer Crop Science, namely "Food chain partnership", "Science for a better life", "Bayer Labhsutra", "Bayer Solutions" "Bayer Farm Helpline" are only some of the most important mechanisms in use for the creation of dependencies of the farmers on the Bayer's products. Bayer Crop Science (BCS) India started to build up a network with various retailers, processors and exporters of high value crops, which included rice, maize, fruits and vegetables, through the Food Chain Partnership (FCP) in 2006. BCS targets only those crops that are in high demand by retailers and processors. These crops include chilli peppers, eggplant, onion, okra, potato and tomato, basmati and rice, maize and so on.

The core idea of FCP is to train project farmers in agricultural practices through the deployment of project officers and field workers. Farmers are given advice on good agronomy practices; they are given knowledge about which varieties to grow, and inputs to use, so that their yields become higher and fetch better prices. In return, the BCS expects the farmers to buy input kits provided by Bayer, and not depend on the products of any other company. The farmers who meet the standards set by the Bayer are certified as BCS farmers and become part of their database. This database is used by companies who are partners in the FCP programme and buy the output of farmers. In this way the Bayer decides which farmer will have access to supply chains of corporate buyers, and which farmers will be excluded from such networks. The FCP is implemented only selected regions and includes only those crops which are the focus of the company (Franz, Felix and Trebbin 2014, Trebbin and Franz 2010). Thus, the decision-making power within the FCP is concentrated in the hands of the Company, and strengthens its overall power vis-à-vis the farmers.

Table 2.2.1: Illustrative Examples of Bayer's Vertical and Horizontal Integration Strategy

BAYER PROGRAMME	YEAR OF INITIATION	GOALS	COLLABORATING FIRMS	COVERAGE
Better Farms, Better Life	2020	Covid 19 Support for small farmers. Distribution of Bayer hybrid seed and crop protection packages, through FPOs registered by government	Emergency response Covid 19 Bayer response	450.000 small farmers. Kharif and rabi crops in rice, cotton, wheat, maize.
Better Life Farming Programme	2018	To provide agri-inputs, market access, farm advice, technologies and digital solutions.	• Bayer for seeds and crop protection • International Finance Corporation (World Bank group) for financial feasibility • Netfim (Swiss MNC) for drip irrigation • Yara (MNC) for fertilisers. • Dehaat, Agri bazaar and Big Basket supermarket chains for market tie ups. • Tata Trusts for formation of FPOs • Axis Bank for credit linked FPOs	• Tie up with Bihar Governments Aajeevika Programme, 2020. • Tie up with Niti Aayog, Government of India for Atal Incubation Mission. • Accessing 20 million farmers inputs, technologies and seeds as of 2020. • 710 better life centres
Food Chain Partnership	2007	Business model developed by Bayer to serve the needs of the food industry. Collaboration between growers, traders, processors and retailers at the local levels also.	Main partners include Reliance Fresh, Pepsico, Nestle, KRBL etc. and a host of other players.	524 Food Chain Partnerships of Bayer across 44 countries in 76 different crops. In India FCP works in rice, Chilli, Okra, Vegetables, etc.
Bayer Learning Centres and digital agriculture	2015 restructured in 2020	Digital learning centre Data science and providing remote solutions	Climate Field View (Bayer Subsidiary), Aegro, AVR Intelligence, Hutchinson etc.	14 learning centres in India: project at very initial stages
Bayer Network	2011	Network of pesticide professionals	Tie up with several agricultural university departments. These departments also validate results of trials and promote the products through their own outreach programmes. For instance, Bayer has collaborated with Government of India's ICAR institutes on several projects.	50 full time professionals
Bayer Labhsutra	2013	Demonstration of seed to harvest solutions		3459 demonstrations in 2013; merged into better life programme.

The table above illustrates the ways in which Bayer has made systemic interventions in order to leverage its position and power vis-à-vis other domestic competitors. The flagship programme, the Better Life Farming initiative, through which the Bayer is trying to consolidate its interventions, also helps it to influence government policies. As is evident from the table, the company has made major collaboration with the Union Government, which is now moving into digital agriculture. It also uses the government's FPO programme to market its own products and influence the direction of Indian agriculture. In this way, one could argue that Bayer attempts to increase its path to increase its structural power and expand the integration of farmers into GAVSs, which has been structured by the neoliberal global order.

3 Exploratory Study of Karnal

3.1 Research Methodology

This exploratory study was undertaken in Karnal Zone to understand the systemic impact of the penetration of transnational companies in GAVS, particular with a focus on farm inputs. The study's methodology included theory-based design of research problem, field research and desk-based research on the corporate conduct and performance. Though the study focused on the interventions of Bayer Crop Science in this zone, it attempted to understand the broad structural changes, particularly with their implications on marginal and small farmers. The study used multiple methods to narrow down the field of inquiry and back it up with secondary data. As the objectives of the project underlined, the main aim of the field work has been to assess what corporate 'integrated solutions' mean for farmers and how they serve as a conduit to create new dependencies for small and marginal farmers. One important aspect of this was gaining insights into the impact of agribusinesses on cost of cultivation and occupational health. These aspects were taken up in the field survey.

The process of the field survey:

Field work was started in end June 2021, when a field team was constituted. The team consisted of people who were experienced in the agricultural extension and had some experience in working with private seed and pesticide companies. After initial interviews with Bayer representatives and the field team, a decision was taken to do case studies of paddy (where Bayer has focused on pesticides), vegetables (in which Bayer attempted foray into seeds and pesticides) and maize, which is used to prepare silage. Since this was an exploratory study the case studies were developed during the course of the field research. Eventually a targeted survey and some focus group discussions were held across the Karnal, Panipat and Kurukshetra districts (which have been identified as the Karnal Zone).

The second step was to identify a set of farmers across different classes and villages to do more in-depth analysis and focus group discussions. A list of 300 farmers was prepared through initial interactions with representatives of the company. These farmers were contacted by telephone and an initial list of farmers was prepared according to the size of their operated holdings. The stratification of farmers was done by land size, and by the crop they had grown in the ongoing season. All farmers were given prior information about the project and their oral consent was taken while conducting discussions. Identification of farmers was based on their willingness to participate and through local networks and contacts. 38 farmers were identified for paddy cultivation, of which a third were small and marginal farmers; thirteen vegetable growers were also identified covering five different vegetables,

most of these were marginal and small farmers. A cost of cultivation and chemical use was implemented. An anonymised data base was prepared for 51 farmers. This database was constructed on the parameters of the All India Cost of Production database in order to make the data comparable. The maize-silage case study was done through a detailed interview with a maize and dairy farmer, who was also an aggregator for small farmers around his farm.

Focus group discussions were held among farmers with each discussion comprising of five to fifteen farmers and covered farmers of different crops, sprayers of pesticides, and women agricultural workers who faced the consequences of excessive use of pesticides during harvest operations. Interviews were conducted with stockists, dealers and exporters. The field team explained the purpose and the methodology of the project to the farmers and obtained their informed oral consent before conducting interviews and focus group discussions. No audio or video recordings were done, and notes on the estimates of farming practices and cost of production were taken with consent of individuals. The business details of the farmer participating in the Maize case study were also taken with informed consent and full knowledge that they will be used in the study.

Supporting secondary data:

Time series data was collected for the post-1990s period to understand the changes taking place in the agrarian structure of Haryana, Karnal, Panipat and Kurukshetra; results were analysed from the Agricultural Census of India, for relevant years. Statistical abstracts of Haryana state were also used for this purpose.

Intensity of pesticide use was analysed for the state and relevant districts from the Input Survey of India, which was analysed crop wise. Further, data on pesticide use, production and imports was taken from time series data available from the website of the Central Insecticides Board, Directorate of Plant Protection. Data on imports from the Ministry of Fertilizer and Chemicals, Government of India, was used to analyse the chemical data. Details of pesticides used by the farmers were collected from leaflets gathered in the field.

The time series data on cost of cultivation was compiled from the cost cultivation data available with the Committee on Agricultural Costs and Prices (CACP). Two years, 2011-2012 and 2017-18, were used for comparison of select aspects of paid out costs incurred by the farmers. Plot level data from three relevant districts was used to compute averages and compare with the data provided by farmers. The limitation of this data is that the farmers provided estimates of only paid out costs and therefore imputed costs were not included in the overall analysis. Further, the field data was compared with the plot level CACP data for the concerned districts, in the case of paddy; such data was not available for vegetables. Timeline for average household monthly expenditure for fertilizers and pesticides was taken from National Sample Survey Organisation's (NSSO), Report on the Situation Assessment of Farmers, 2013 and 2019. This data was, however, only available at the state level.

Narrative and data on Bayer's interventions are based on the Annual Reports of Bayer Crop Science, India and the reports available on the Bayer Crop Science Global website, sustainability reports and information on Food Chain Partnerships. The details of the reports used in the narrative are cited in the appropriate places and in the bibliography . Narratives and data on pesticide impacts on cropping practices were also taken from secondary literature.

Definition and Assumptions for statistical analysis and comparisons in case studies:

1. Definition of size class of farmers as used in agricultural census and used in this paper also:
   a. Marginal farmers: those operating less than one hectare of land.
   b. Small farmers: those operating 1.0 hectares to 1.99 hectares.
   c. Semi-medium farmers: those operating 2 hectares to 3.99 hectares
   d. Medium farmers: those operating 4 hectares to 9.99 hectares.
   e. Large farmers: those operating above 10 hectares of land.

2. Calculation of pesticide intensity:
   a. Intensity of pesticide use by area:
      total area treated with pesticides / total cropped area.
   b. Intensity of pesticide used by quantity: total quantity of pesticide used / total yield.

3. Imputed costs in cost of cultivation:
   a. Rate used for imputed cost of family labour: average daily wage paid to agricultural labour / number of hours worked: working out to INR 46.52 per hour.
   b. Imputed of land rent: current market rent for one season. The farmers leasing in land pay INR 27000 per acre per season. If one hectare – 2.404686 acres, then by our calculation seasonal rent is 64926.52 for six months. For each farmer, this figure was multiplied by total cropped area for owned land and total leased in area for leased land.
   c. Imputed cost of own machinery: average cost per hectare of hired machinery as reported by farmers minus 20% for depreciation.

4. Paid out costs include all out-of-pocket expenditure as reported by the farmer:
   a. Cost of seed
   b. Cost of fertilizer
   c. Cost of hired machinery
   d. Electricity and irrigation charges.
   e. Cost of insecticides / pesticides
   f. Leased-in rent.

In this paper cost of cultivation has been assessed mainly in terms of paid out costs.

3.2 Karnal Zone, Haryana-Field Area Description

Karnal Zone includes three districts-Karnal, Panipat and Kurukshetra. It is an important administrative unit for the development of agriculture in Haryana, which is predominantly an agricultural state. Haryana is located in the northwest part of the country and the climate is arid to semiarid with average rainfall of 455 mm. Around 70% rainfall occurs during between July and September and the rest in the months of December to February. The total geographical area of the state is 4.42 million hectares (m ha), which is 1.4% of the geographical area of the country. The cultivable area is 3.8 m ha, which is 86% of the geographical area of the state out of which 3.62 m ha, i.e., 96.2% is under plough. The gross cropped area of the state is 6.51 m ha and net cropped area is 3.62 m ha with a cropping intensity of 179.69% in the year 2012–13 (Government of Haryana 2014).

The 84% of net-cropped area is irrigated. In the State, about 68.17% of the cropped area is under food grains and the remaining 31.83% area is under non-food grains. The food grains comprise mainly cereals and pulses with weights of 67.06 and 1.11% respectively. Non-food grains consist of oilseeds, fibre and miscellaneous crops with weights 6.09, 16.60 and 9.14% respectively. The major crops grown in Haryana are: wheat, rice, mustard, cotton, sugarcane and pearl millet, locally known as bajra. The contribution of area under wheat and paddy crops to the total gross area sown is about 59.3%.

Haryana has made great strides in food production during the era of Green Revolution. However, this success has resulted in second-generation problems such as a declining resource base, especially reduction in soil organic carbon content, multiple nutrient deficiencies, poor soil health, hydrological imbalance, decline in underground and above ground biodiversity and pollution of soil, water and environment. In addition, there had been a gradual decline in the water table in areas having good quality ground water due to the cultivation of high-water requiring crops like rice, wheat, sugarcane and cotton. The major limitations of Haryana soil are: (a) the poor organic carbon, and (b) deficiency of micronutrients (Goswami, Bezbaruah and Mandal 2018, Patel and Panghal 1997, Shiva 2016).

The cropping pattern in the study area has undergone a substantial change with wheat and rice emerging as a major crop rotation in Haryana. In the western and southern agro climatic zones crops that have need replaced by wheat and rice are gram, bajra, barley, millets and pulses. The change was the most spectacular in the case of gram area share of which declined from 20.59% to 3.77% during 2012–14 to 2016–18. In the western agro climatic zone appears to have had the best potential for increasing area in favour of oilseeds and pulses. Yet in the zone, the area under wheat and rice had shown the sharpest increase.

The northern agro climatic zone of the State comprising Kurukshetra, Karnal and Panipat districts had very high levels of concentration of rice. Even though the the rainfall in this zone was adequate to meet fanmers requirements, the areahas continued to enjoy fairly good irrigation facilities to reduce risks in rice cultivation. Rice had gradually now become the most remunerative crop in the kharif season with no other functional alternative at present. This is a kind of compulsion for the farmers and therefore they continue to grow rice. The cropping pattern of the state has unnecessarily become energy intensive and affects the static balance of the underground water resources in the plains of Haryana. The growth of infrastructure, irrigation and other technological factors have contributed to a major shift in cropping pattern in favour of the rice-wheat rotation (R-W), in the State. The crop diversification index moved in a narrow range during the post reform period in almost all the agro climatic zones. The Ministry of Agriculture and Farmer Welfare (with the support from the Indian Council of Agricultural Research) flagged this issue in its policy paper of 2020 (Rakshit, et al. 2021); the paper calls for the introduction of measures of crop diversification, crop rotation, balanced use of fertilizers, and rational pesticide applications to bring back the farming system of this region to good health[19]. Problems of the region are a result of the inability of region to move away from the lock-in of the farming system into R-W cropping system. After the sixties the three districts Karnal, Kurukshetra and Panipat were rapidly taken through the processes of "green revolution" strategy enabled by capitalist socio-technical transformations by the Indian state.

Even though crop diversification was limited even prior to reforms, the reforms intensified the declining trend and the average crop diversification index value of the State decreased from 0.67 to 0.65. Decrease in the crop diversification index value was observed in the western and southern agro climatic zones of the state. The study covered areas of „low" crop diversification covered the northern agro climatic zone in Ambala, Kurukshetra, Karnal, Panipat of the northern, and Kaithal, district of the central agro climatic zone. During the post-reform period, the farmers of this region abandoned their traditional cropping practices in favour of the government-supported and more remunerated R-W cropping pattern (Kumar, et al. 2019).

19 The region is yet to embark on the changes proposed by the Ministry of Agriculture and Farmer Welfare. Policy Paper (2020), R-W Cropping System Haryana, Ministry of Agriculture and Farmer Welfare, 2020 (ICAR-Ministry of Agriculture and Farmers Welfare 2020)

The rice-wheat cropping system is already facing a serious crisis in all the three districts of Karnal zone. Rice cultivation picked up momentum only with the implementation of the green revolution strategy and was widely taken up from the seventies onwards. This is a period when the government subsidized the adoption of high external input systems of agriculture. The State developed this region as a major food grains producing area of the nation. Although in the beginning the rice-wheat cropping system started with canal irrigation, soon tube well irrigation came in, putting pressure on ground water on the one hand and the energy budget on the other.

The average size of operational holding in Haryana is 2.25 hectares compared to the national average of 1.23 hectares, next to Punjab in North India. The marginal and small farmers are accounted for 46.1% of these holdings. The medium and large farmers have 19.3% and 34.7% of total farm holdings respectively (Government of Haryana 2014). The total number of farm holdings is 15.28 lakh. From the updated account of proportion of landholdings and operational area controlled by size class of land at the level of the three districts namely Karnal, Panipat and Kurukshetra, our field area for the study (Annexure 2), it is quite clear that the area has experienced an increased pattern of land inequality as reflected in the changing land structure since 1970–71. However, the nature of tenancy has changed significantly after the reforms; landless peasants began to lease-in lands in order to produce on contracts of various kinds. But, the percentage of total cropped land under their control has decreased significantly. There was a further concentration of land in the hands of middle and large peasants (Bansal, Usami and Rawal 2018, 41–47). This is also evident in the sample of farmers chosen in this study. These structural inequities were evident in the field survey.

3.3 Patterns of Integration into GAVS and its Impact in Karnal

As pointed out in the previous sections, the promotion of 'integrated solutions' is a way of facilitating vertical and horizontal integration of different segments of peasantry, traders and businesses into GAVSs. The indications of such integration and their socio-economic implications are discussed in the findings of the exploratory case studies:

3.3.1 Case Study1: Pesticides, Paddy Production and Patterns of Integration

Bayer's 'Integrated Solutions' for Paddy

Bayer's annual reports and websites reveal that their 'integrated solutions' for rice production are focused on good quality, high yielding seeds through the development of high yielding rice varieties (Arize), crop protection and interventions in agronomic practices. Introduction of the Arize seed has only been undertaken in non-green revolution areas, where seeds of high yielding varieties were not introduced or distributed by the government's agricultural extension service. The full scope of Bayer's interventions with respect to paddy seeds can be gauged by its implementation of the Better Life Programme. In 2019 the company undertook a three weeklong programme on managing agronomic practices in rice management in Jharkhand, Chhattisgarh and Odisha which "aimed at introducing rice smallholder farmers to advanced agricultural technologies in the areas of seeds, crop protection, crop nutrition, soil management, drip irrigation, post-harvest management, and financial literacy" (Bayer Crop Science India 2021, 103).

In Northern India, particularly Punjab and Haryana, Bayer Crop Science claims that it is focused on reducing pests and tackling crop losses occurring due to lack of storage and faulty agronomic practices. It has partnered with one of the largest rice exporters in India, KRBL, under the Food Chain Partnership programme to develop crop protection kits. These crop protection kits promoted brands like Native, Fame and Confider which are currently in common use in the region. The KRBL distributed good quality Pusa seeds and promoted Bayer agro chemicals as a method of good agronomic practices (Food Chain Partnership 2011, 1–3). Hence, the Food Chain Partnership programme, aimed to integrate farmers into the agricultural value systems through the use of agro chemicals.

From Bayer's perspective, their products provide a solution to farmer's multiple problems. This is confirmed by the Bayer representative in our initial visit where he stated that, as far as paddy was concerned, the company had focused mainly on pesticides, since the seeds of available Pusa varieties gave good yields for this region. The case of paddy provides insights into the vertical integration of all classes of paddy farmers into the agricultural value systems, which are dominated by a combination of corporate players in the Karnal Zone. In Karnal, Paddy seeds are still provided by the government agricultural research system, with most of the 37 surveyed farmers are planting PR 114, a non-basmati high yielding variety. It was mainly the medium and large farmers who grew the basmati varieties of PB 1509, PR 1121 and PB 1. A couple of farmers combined these with aromatic rice varieties. In Karnal, the farmers follow a rice-wheat cropping rotation. Some also use a part of their fields for vegetable production. Field investigators unearthed the dynamics of the agricultural value system through the specific analysis of pesticide and insecticide usage and its economic, environmental and health impacts on farmers.

Profiling the Surveyed Paddy Farmers:

Paddy is a major Kharif crop in the region. It is produced by all classes of farmers. As the table below shows a significant class differentiation, and concentration of assets within this green revolution region:

Table 3.3.1 Farmers by Size Class of Holdings (Computed from Primary Data)

	SAMPLE SIZE	LAND IN HECTARE				PERCENTAGE OF TOTAL LAND CONTROLLED OUT OF LAND HELD BY ALL FARMERS
		TOTAL AMOUNT OF IN POSSESSION	TOTAL IN HA OUT OF POSSESSED LAND		TOTAL CROPPED AREA IN HECTARES	
			SELF OWNED	LEASED		
Operating Only Leased in Lands	**11**	**23.26**	**0**	**23.26**	**18.42**	**6.82**
Marginal	3	2.02	0	2.02	1.21	0.45
Small	4	6.27	0	6.27	4.66	1.73
Semi-Medium	3	6.88	0	6.88	4.86	1.80
Medium	1	8.09	0	8.09	7.69	2.85
Wholly Owned Lands	**23**	**248.01**	**225.01**	**0**	**216.4**	**80.14**
Small	3	4.25	4.25	0	3.64	1.35
Semi Medium	2	4.05	4.05	0	4.05	1.50
Medium	12	73.05	73.05	0	66.4	24.59
Large	6	143.66	143.66	0	142.31	52.70
Partly Leased Partly Owned	**3**	**35.61**	**24.28**	**11.33**	**35.21**	**13.04**
Medium	2	13.35	6.47	6.88	13.35	4.94
Large	1	22.26	17.81	4.45	21.86	8.10
Total	**37**	**306.88**	**249.29**	**34.59**	**270.03**	**100**

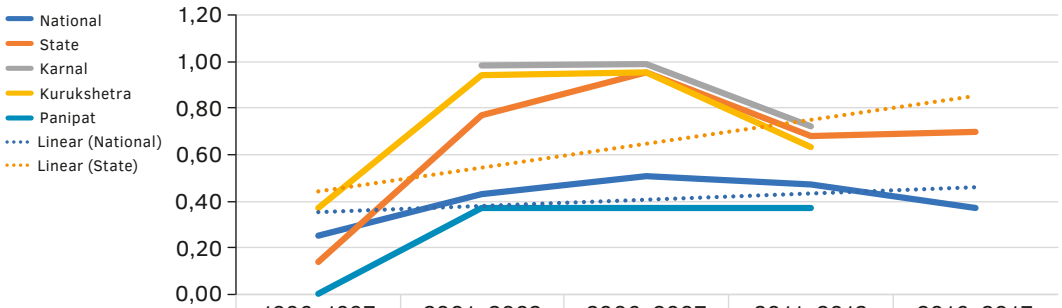
As is evident, though farmers operating wholly leased-in lands constitute one third of the surveyed sample and only own 6% of the total land. In contrast, seven farmers control more than two third of the total land. Further, marginal and small farmers, constituting about a third of the surveyed farmers, control just above 2% of the surveyed holdings. This pattern shows that there is a concentration of assets amongst a few farmers, with medium and large farmers controlling more than 80% of the operated area. The concentration of control over land in a few hands is a familiar pattern, which has been pointed out by relevant studies (Bansal, Usami and Rawal 2018) and is also corroborated by the data collected through the Agricultural Census and presented in Annexure 2. Such a phenomenon highlights the different degrees of dependence that farmers may have on traders or agribusinesses. One significant marker is that farmers having access to land and owning machines had a better capacity to withstand the onslaught of competition and withstand the shocks that came with the onslaught of corporate interventions than others. The field investigations also point to this factor, thereby indicating that the small / marginal farmers are more adversely impacted with their integration into value systems.

Bayer's Strategy of Pesticide Sale and the Extent and Intensity of Pesticide Use

An analysis of pesticide uses in the districts of Karnal and Kurukshetra through the data provided by official input surveys of different years shows that the average intensity of pesticide use is much higher than the use of pesticides at national and state level. The only exception was Panipat, where pesticide usage was lesser than the other two districts as well as pesticide usage at national and state level. However, the trend for pesticide usage in Panipat is also on the rise similar to its usage at national, state and in the district of Kurukshetra.

Among the three districts Kaarnal was the only district where pesticide use for paddy saw a declining trend; nevertheless we find that between 2006–2007 and 2011–2012, the intensity oof use was still extremely high at 0.90. This means pesticide usage in Karnal surpassed the state level use by 1.3 times at state level in 2006–2007, when it was at its peak and it was already 2 times higher than the national average. Further, the ratio of pesticide usage has been calculated from pesticide used for paddy and the total area used for paddy cultivation. The national average across all land holdings was 0.43 and was lesser than pesticide usage for paddy in Haryana (0.95) and the districts of Karnal (0.99) and Kurukshetra (0.95). Small land users, similar to pesticide usage for wheat, applied pesticides on less land as compared to large land holders. Pesticide usage was also the highest during the time period 2006–2007. A trend analysis of pesticide usage in the state and three districts reveals that both these districts and the state have seen a usage that is much higher than national averages.

Graph 3.3.1: Ratio of Area Treated By Pesticides: National, State and District



	1996–1997	2001–2002	2006–2007	2011–2012	2016–2017
National	0,25	0,43	0,51	0,47	0,37
State	0,14	0,77	0,95	0,68	0,70
Karnal		0,98	0,99	0,72	
Kurukshetra	0,37	0,94	0,95	0,63	
Panipat	0,00	0,37	0,37	0,37	

Source: InputSurvey of Different Years

A large farmer of paddy and maize in Singhra village also confirms that there has been inten-sification in the marketing by pesticide companies in the last few years because crop diseases have also increased. He suggested that the pesticide companies have targets, and sell directly through agents, most of who have no training in the composition or application of pesticides. Data on the length of time for which Bayer pesticides have been used by surveyed farmers gives supporting evidence of this increasing use:

Table 3.3.2: Length of Time of Use of Bayer Chemicals (Primary Survey)

NO OF YEARS	WHOLLY LEASED FARMERS				WHOLLY OWNED				PARTLY OWNED PARTLY LEASED	
	Marginal	Small	Semi-Medium	Medium	Small	Semi-Medium	Medium	Large	Semi-Medium	Large
3		4	1		2		3	1		1
4	3		1		1	1	4	1		
5						1	5	2	2	
6			1	1			1			
7								1		
8								1		
9 or more										

The table given above is instructive as it shows that the most vulnerable small and marginal farmers (especially those with leased lands), have only been using the pesticides of produced by Bayer for the last 3–4 years. Almost 50% of the farmers surveyed had been using Bayer chemicals for more than five years. Farmers with greater resources appear to have been integrated into Bayer's network for a longer time compared to small and marginal farmers. The semi-proletarianisation of these farmers (as indicated in the last section), seems to have been a factor in inducing this integration.

Profile of the Chemicals Used

Field investigations reveal that pesticides and insecticides are used by all classes of farmers, and at all stages of cultivation[20]. Of these, in surveyed farmers, a majority of the chemicals were of Bayer Crop Science. Farmers also reported the use of a few of the chemicals, which were marketed by Syngenta, and Dupont. Only one of the leaflets gathered from the farmers could be traced to the source of a domestic company which imports the raw materials for its production. Below, we reproduce and analyse the information for the chemicals reported in rice cultivation:

Table 3.3.3: Chemicals Used by Farmers

BRAND	TYPE OF PRODUCT	CHEMICAL	REGISTERED TRADEMARK	MANUFACTURED BY	MARKETED BY	HOW MANY FARMERS USING AND IN WHICH OPERATION
Fame	Insecticide	Flubeniamide 39.35%	Bayer Group	Saraswati Agro Chemicals, Jammu	Bayer Crop Science Ltd	14 for sowing 5 for other operations
Nativo	Systemic Fungicide	Tebuconazole 50%, Trifloxystrobin 25%	Bayer Group	Bayer AG Germany	Imported and repacked by Bayer Crop Science Ltd	3 farmers for nursery 4 farmers for sowing 17 for all other operations
Regent 5% SC	Insecticide	Fipronil 5% SC	Bayer Group	Saraswati Agro Chemicals, Jammu	Bayer Crop Science Ltd	4 for nursery 11 for sowing
Sygenta Rift	Herbicide	Pretilachlor 50%	Syngenta	Sygenta India		22 for nursery
Chess	Insecticide	Pymetrozine 50%	Syngenta	Syngenta Korea and imported and repacked by Syngenta India	Syngenta India, Pune	3 for other operations
DuPont Galileo	Systemic Fungicide	Picoxystrobin 7.05%, Propiconazole 11.71%	DuPont	DuPont India, Pvt Ltd. Gurugram Haryana	DuPont India, Pvt Ltd. Gurugram Haryana	4 for other operations.

Source: leaflets gathered by field team and survey

The table above shows, that in relative terms, the penetration of Bayer's imported Nativo pesticide is the highest. 34 farmers have also used other chemicals such as Bayer's Bavistin (Carbendazin 50%) and 33 use the generic chemical Butalchlor at different stages for preventing weeds. The most marketed and popular of these chemicals, i.e., Nativo and Fame are either imported or made out of imported raw materials (as indicated in section 2).

20 Information was collected for pesticides used at the nursery, sowing and flowering stages.

Pesticides are not applied according to any prescribed method and most of the pesticide sellers have no ability to communicate the products' risks to farmers. Although companies maintain databases of the region's farmers, they have no system of collecting information on the chemicals' impacts on soil or plant health. This was echoed in almost all focus group discussions across the zone. The central stockist of Bayer products for the Karnal zone confirms this lacuna. He suggested that companies meet their targets by establishing a direct connection with farmers. They try to eliminate middlemen and create village level nodal officers.

Focus group discussions across villages reveal that commission agents and traders sell pesticides to farmers without the prescription of crop protection specialists. The view of these agents / traders is that there is no need for the products' registration for the market in India. Companies expand their sales through all of these methods and take help from commission agents. In addition, companies incentivize sales by occasionally using the promotion of discounts to sell their stocks of chemicals to farmers, the ultimate users or buyers. The farmers' relationship with these agents is complicated because they provide access to new pesticides, and also buy the farmers' output .

Analysis of the survey results of 38 farmers shows that almost all farmers buy pesticides from traders. Many also sold their produce to the same trader. In this sense, the markets for input supplies and output sales are interlocked with each other, which makes the farmers dependent on traders for choice of chemicals. The use of the trader network to expand the Bayer market is acknowledged by the company representative, central stockists and the farmers themselves.

The Treadmill Impact of Pesticide Use

Since the introduction of the first synthetic pesticides, there has been a continuous succession of the use of chemical classes and modes of action in this region, e.g., carbamates and pyrethroids succeeded organochlorines and organophosphates. It is believed that they are less toxic to humans and wildlife. Some farmers who were knowledgeable about the pesticide problem also reported that the sale of banned products is still continuing in Karnal without effective monitoring by State departments[21]. It is evident that a majority of the farmers, irrespective of size class of land, use multiple pesticides in paddy cultivation in one season:

21 Since their introduction in the 1990s, neonicotinoids have rapidly diffused as insecticides. Their systemic mode of action, high efficiencies at low doses and their presumed less toxicity to vertebrates including humans, have enabled the diffusion. Even while these issues and concerns, with respect to widespread and unguided usage combined with a myriad of non-target effects of these pesticides, are known to the research community there is no monitoring of infestations by the departmental staff (Bakker, et al. 2020).

Table 3.3.4: Number of Chemicals Used by Size Class of Land and Tenancy Status

NO. OF CHEMICALS	WHOLLY LEASED FARMERS				WHOLLY OWNED				PARTLY OWNED PARTLY LEASED	
	Marginal	Small	Semi-Medium	Medium	Small	Semi-Medium	Medium	Large	Semi-Medium	Large
2	1				1					
3	1	3	1		2		4	1		1
4		1					2	1		
5	1		1	1			1	1	2	
6						1	2	1		
7			1				2	1		
8						1	1	1		

As is evident, a majority of the farmers (22) use more than four chemicals on their paddy crops in one season; eighteen of them utilise at least five chemicals in the season; those using six chemicals or more are farmers who cultivate four hectares and above.

The nature of use is reflected in the interview of a knowledgeable honorary field investigator, with experience of working as an agent of many of these companies. In one of his examples, the trader/agent prescribed Bayer's Raxil Easy for seed treatment and good productivity in one season; it was instructive that this chemical was earlier used for wheat and not for rice. Thereafter the crop developed weeds and the agent prescribed Bayer's Adora and Top Star for the prevention of growth of weeds and grasses. Thereafter, four versions of Bayer's Regent pesticide were used to treat stem borer at different points in time. After this, the crop caught the sheath blight pest and the farmer was recommended the use of the same company's Folicur and Monceren at the same time; thereafter the stem borer returned to the field and Fame and Nativo were used to treat stem borer once again. Thereafter, the crop was attacked by Hopper, and Bayer's Gadamore was used for treatment. In all, at least eight Bayer chemicals were used on one crop, thus increasing the dependence of the farmers on these chemicals.

Preliminary investigations in Karnal confirm one more exploratory conclusion with regard to the pervasiveness of the pesticide treadmill effect reasonably well. A key driver for pesticide development is pest resistance to pesticides, limiting the effective time span for a pesticide. Broad spectrum insecticides reduce natural enemy populations and disrupt biological control. This creates an increased dependence on insecticides, which reduces the resistance to pests; therefore, the farmer increasingly relies on chemical pest control while simultaneously, biological control is weakened. Such a process has been referred to as the pesticide treadmill, in which farmers increasingly keep using insecticides and companies keep introducing the use of more and newer products to solve a pest problem (Hansen 1988, DeBach 1951, Bakker, et al. 2020).

Pesticides, Labour Use, Machinery and Capital Equipment Services

The web of corporate initiated pesticides has been accepted by farmers because they believe that they have no other choice if they want to increase their productivity. Almost all the 38 surveyed farmers gave a standard answer for the use of these pesticides and insecticides, respectively, in these cases: these chemicals are recommended because they increase productivity and reduce their risk of crop loss. All of them also stated that the pesticide had a moderate impact on the quality of the crop.

In addition, some large farmers owning more than 10 hectares of land, believe that this is the best method of raising productivity and increasing income. Many of them have been growing Basmati (PB1509), vegetables (mainly potatoes), and wheat / maize, whose produce can be enhanced through increased use of pesticides, and fertilizers. They also replace hired labour with their own machinery. For example, our interviews with two large farmers in Faridpur and Jamalpur reported that they were doing farming with minimal dependence on agricultural workers, and were using seeders and combines for different operations. In this manner, the farmers reduced their costs, and increased use of pesticides was raising their yields, which were earlier undertaken with the help of labour. It was pointed out that the occurrence of stubble burning was less in areas growing basmati and harvesting produce with the help of agricultural labour without using machines. Even though their cost of pesticides had increased, they had saved labour costs, and increased their income[22].

It is important to highlight that almost all farmers operating more than 2 hectares of their own land (22 out of 38 surveyed) have their own machines. Almost all the marginal and small farmers (14 out of 28) operated on basis of family labour and partly hired machines. Farmers leasing in

22 Focus group discussions with farm labour in the same villages resulted in an overall understanding that machines and pesticides affected employment and wages in rice production. For example, women workers of Faridpur, eighty five per cent of basmati harvesting took place with the help of women agricultural workers, get lesser wage compared to men. Women agricultural workers have to work for 10–12 hours. They can only get a daily wage rate in the range of Rupees 180 to 250. They come from poor agricultural households and have no option but to accept these wage rates. Further field investigations brought out that in the Mahatma Gandhi Rural Employment Guarantee Scheme (MNREGS) women agricultural workers can get a daily wage rate of Rs 325. Agricultural workers and farmers suggested that MNREGS scheme should be utilized to support the wages for harvest of paddy including basmati rice. Farmers pointed out that the occurrence of stubble burning was less in areas growing basmati and harvesting produce with the help of agricultural labour without using machines. Farmers pointed out that the occurrence of stubble burning was less in areas growing basmati and harvesting produce with the help of agricultural labour without using machines, and because of rising labour cost basmati producers had started using combines for harvest operations. Agricultural workers and farmers suggested that MNREGS should be utilized to support the wages for harvest of paddy including basmati rice. This will allow the region to solve the stubble burning problem as well. Farmers cost of production will lessen. In order to prevent stubble burning farmers are spending Rs. 6000 to 7000 per acre. Farmers also brought out that stubble burning was far more associated with non-basmati paddy of PR 114 variety which uses combines for harvesting. During Kharif season this year farmers cultivating PR 114 incurred a figure of close to Rs. 11000 per acre on average to control the growing load of pests and disease in this region.

land above 2 hectares worked on the basis of a combination of hired machines, own machines and labour. It is quite clear that labour saving techniques were employed by most farmers, who had the assets to make some investments. They also saw the use of pesticides as a substitute for labour.

Pesticides and the Cost of Paddy Cultivation

Following from the preceding discussion, it is pertinent to highlight the changes taking place within the cost structure of cultivation. The discussion here is largely based on field data collected on certain aspects of the cost of production, and mainly analyses the different paid out costs of different classes of farmers:

Table 3.3.5: Proportion of Select Inputs in Total Paid Out Costs (Computed from Primary Data, 2021)

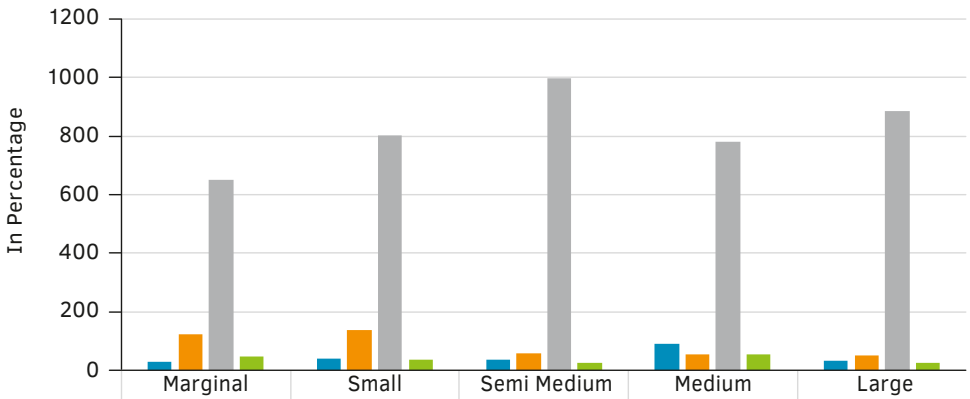
SIZE CLASS	SAMPLE	PERCENTAGE OF TOTAL PAID OUT COST							
		Seed	**Fertilizer**	**Hired Labour**	**Hired Machine**	**Electricity & Irrigation**	**Insecticides / Pesticides**	**Lease Rent**	**Remarks**
Wholly Leased	**11**								
Marginal	3	0.5	6.9	10.6	11.3	1.1	12.7	54.8	Loss of 20000–22000 / ha
Small	4	1.1	7.7	13.7	7.3	1.7	16.6	49.9	1 Farmer has good yield of export quality Basmati earns about 22000: rest average income of about 4000–5000 per hectare.
Semi-Medium	3	0.8	5.3	12.4	20.4	0.05	16.9	56.9	1 farmer has good yield of export quality Basmati getting about 50000 per hectare. Other two farmers are running in negative income of about 20000–60000
Medium	1	1.4	5.8	15.7	7	0.9	18.9	50.1	Net income of about 38000 per hectare growing export quality
Wholly Owned	**23**								
Small	3	1.7	14.3	27.7	12.1	3.3	23.8	0	The average income of these farmers is about 70 000 per hectare and most of them are doing export-oriented crops
Semi Medium	2	2.4	13.5	30.8	0	3.7	37.7	0	Both farmers are doing Pusa Basmati and earning about 1 lakh per hectare in one season.
Medium	12	2.2	13.9	29.4	0	1.5	38.7	0	Per season income is about 77000 per hectare
Large	6	1.9	12.2	30.4	0	2.6	38.5		Average income is about 87400 / ha in one season
Part Lease Part Own	**3**								
Medium	2	1.3	8.3	20.2	0	0.7	27.1	32.7	Average income about 70000 / ha per season
Large	1	2	11.7	19.8	0	2.2	35.5	16.9	Average income is about 80000 / ha per season

The table above leads us to a couple of important insights: first, pesticides, lease rents and fertilizers are the main drivers of increase in paid out costs. The pesticide costs are about 12–17% of the total costs for marginal and small farmers, but increase to about 22–35% of paid out costs for others. This is mainly because the paid-out costs of farmers with their own lands and machines are much lower than that of marginal and small farmers, who may not own these assets. These insights are confirmed by several studies and surveys which have reported the rising costs of production in green revolution regions (Singh, Bhangoo and Sharma 2019, Ministry of Agriculture 2017, NSSO 2021, NSSO 2014)

Second, as illustrated, small and marginal farmers leasing in lands are running into losses or just about breaking even vis-à-vis their paid-out costs. However, if we include their family labour, farmers of all classes will run into losses. Third, for small farmers who own their own lands, the situation is only a little better, for if the imputed costs of their family labour and rents are included, they will all be incurring losses. Fourth, the situation of medium and large farmers with their own lands and machines is much better as far as cash income is concerned, however they too run losses if the imputed land rents and costs of farm management are included in the costs. As per the market rates, imputed land rents are about INR 65000 per hectare for one season. The leased rents are also calculated on this basis.

The conclusions of the table show, that marginal and small farmer are at a greater dis-advantage than others, and this is reflected in the rising cost of pesticides from secondary and primary data:

Figure 3.3.2: Percentage Rise in Select Input Costs , 2012–2021



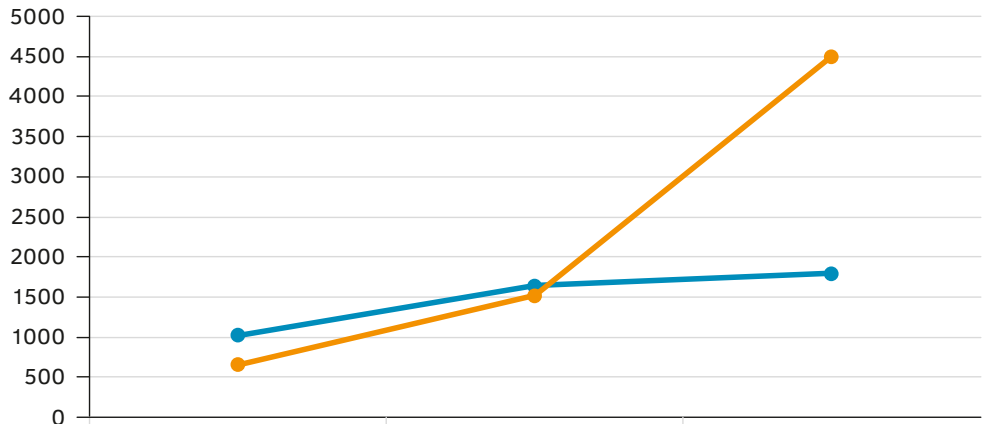
	Marginal	Small	Semi Medium	Medium	Large
Seed	28,38	40,38	37,24	91,26	35,45
Fertiliser	125,40	137,39	58,84	56,87	50,20
Agro Chemicals	649,13	800,48	996,61	780,84	883,02
Hired Labour	48,39	38,16	25,70	56,27	26,20

By Size Class of Land

Source: Plot Level Data from CACP database of different Years and Primary Survey

The table shows at the though both pesticide and fertilizer costs have risen exorbitantly in the above-mentioned period, the pace of rise in pesticide costs in much higher than that of fertilizers. Further, it is instructive that the rise in the costs of paddy seeds more reasonable, and perhaps reflective of the fact that most farmers still use subsidized seeds from the ICAR system. The rising cost of fertilizers and pesticides is reflected in the three-fold rise in monthly expenditure of these households in paddy cultivation:

Figure 3.3.3: Average Monthly Household Expenditure on Paddy For Fertilizers and Pesticides



	2011–2012	2017–2018	2021
Fertiliser	1025	1644	1795
Pesticide	655	1519	4502

Source: NSSO 2013, 2021 and Primary Data

Here too, it is important to note, that the indications are that the percentage increase in fertilizer is much less than that of pesticides, where out of pocket expenditure has risen by about three times[23]. This is also revealed by the surveyed farmers. The average expenditure of a marginal and small farmer on pesticides is about INR 12000–13000 per hectare; they report that their total expenditure on pesticides was about INR 1500 10 years ago and about INR 3000–5000 five years ago. For medium and large farmers, it can range from INR 14000–16000; their total expenditure on pesticides was about INR 15000 ten years ago. Vertical integration into transnational-led pesticide supply chains has led to an exorbitant rise in input costs, even though they may have led to some yield increases.

23 The sample sizes of NSSO and Plot level Data of Cost of Production Surveys also indicate a twofold per hectare increase between 2012-2018. Further increase in paid out pesticide costs in paddy cultivation has also been recorded for certain other districts of Haryana like Kaithal (Nirmala and Muthuraman 2009.).

As analysed above, rising costs have had a disproportionate impact on small and marginal farmers, and this is related to their cropping patterns and impact on forward linkages. Most marginal and small farmers grow high yielding varieties (PR 114) for the domestic market. The slump in public procurement has impacted them more. The farmers breaking even or making marginal surplus income are growing export-oriented basmati. Medium and large farmers growing export-quality basmati also have positive impacts on incomes. However, they calculate these incomes without taking into account imputed costs.

At an average, a small farmer with her own lands and growing export varieties may earn about INR 6000 per hectare after including all imputed costs. For those not growing these varieties, there are losses of about INR 30,000 after including family labour and rent. For semi-medium and medium farmers too, the situation is not much better; they could end up earning around INR 11,000 per hectare per season; for large farmers the same is an average of INR 31,000 per hectare in one season without including imputed rents. This implies that if all imputed costs are included, even farmers with assets would make meagre incomes or break even in paddy production. It is therefore not surprising that farmers are demanding the minimum support price (MSP) for all varieties and crops.

Residues, Toxicity and Company's Promotion Strategy

Rising cost of production is one of the causes for low incomes of farmers. An additional factor for higher costs and low returns to pesticides is the problem of excessive use of pesticides. This factor has been brought out in our discussion with one of the largest rice exporters in the area. The exporter states that use of Bayer pesticides leaves unacceptable amounts of residues, and leads to rejection of produce by contracted parties. In other words, the use of pesticides creates a problem even for traders in the competitive export market.

An interesting observation by the exporter is that the excessive use of pesticide is structured into the methods by which the companies operate in order to maximize their profits. For example, he explains that irrational use of pesticides continues because the companies do not care to recruit qualified staff and have not able to develop extension services of desired level. The companies must take responsibility to help farmers and sprayer workers to ensure the safe use of pesticides in paddy cultivation. He suggests that such residues do not arise from produce grown by farmers contracted by Bayer itself. Of course, such farmers are few in number. Bayer sells the products mostly through commission agents and retail traders. Further, products are sold in a packaging that contains high quantities of pesticides rather than in amounts that are actually needed. Labels are too small to read and understand, information is not transparent, so farmers use the chemical in the way that the company tells them to use it.

Information from the exporter is further confirmed and supported by the secondary information available on brands like Nativo and Fame, which are commonly used in rice. Nativo, which is used by almost all rice farmers, has labelling problems, as documented by the European Centre for Constitutional and Human Rights in 2015 (ECCHR 2015). Doing a case study of Nativo, the Centre wrote that German pesticides are not being sold with adequate warnings. This has been further followed up against several cases with focus on Bayer and Syngenta's practices. The rice exporters' organization has also demanded a proper monitoring of these pesticides. This documented evidence, appears to corroborate the view that aggressive promotion strategies are impacting farmer's choices.

Occupational Health and Use of Pesticides

One of the findings of the survey concerns the occupational health dimensions of using pesticides. Pesticides are sprayed on crops by human labour in Karnal. The number of deaths caused and the complaints of ill-health by sprayers are known but not attended to by either the companies or the regulatory apparatus of the Indian government. Our investigations reveal the following pattern of deployment of sprayers:

Table 3.3.6: Use of Sprayers by Paddy Farmers

	WHOLLY LEASED FARMERS				WHOLLY OWNED				PARTLY OWNED PARTLY LEASED	
	Marginal	**Small**	**Semi-Medium**	**Medium**	**Small**	**Semi-Medium**	**Medium**	**Large**	**Semi-Medium**	**Large**
Sprayers employed by farmers	0	1	2	1	1	2	12	6	2	1
No of days	0	4	5 and 7	5		1 and 3	2–10 days	6–30 days	5 and 15	20
Total cost (INR)	0	1500	NR / 1800	3000	1200	1600 and 2000	2500–4000	8000–48000	3500–3600	3000

Source: Primary Data

The table shows, that small and marginal farmer spray their own pesticides in comparison with medium and large farmers. Hence, they are also more exposed to the risks of spraying pesticides. In addition, many of the marginal farmers also do wage labour to spray pesticides on the farms of medium and large farmers. Focus group discussions with such farmers reveal devastating health impacts, with some even losing their lives because of the long-term impact of pesticides. We do not deal with this here, in detailed manner because a subsequent case study is devoted to the problems of the sprayers. It is sufficient to state here that small and marginal farmers face more health risks than medium and large farmers. This theme is discussed further in Section 3.4.

3.3.2 Case Study 2: Corporate Consolidation and Vegetable Production

Bayer Crop Science's 'Integrated Solutions' for Vegetable Farmers

The Monsanto-Bayer merger in 2018 paved the way for the expansion of Bayer Crop Science operations into the seed business; Seminis seeds, which had been developed by Monsanto, became part of Bayer's portfolio. Bayer's interventions in vegetables had started earlier under projects for okra, potatoes, and red chilli. Bayer had even set up a field station to do R&D in vegetables in Karnal. This effort had culminated in a field station in 2015, in Karnal. Internet knowledge about this field station was, however, not backed up by the team members who undertook field visits; there was also no subsequent mention about the station in Bayer reports. Now, the station has been re-inaugurated in 2020, with a new focus on a development on new traits and seeds, particularly after the successful merger of Seminis with Bayer.

The role of Bayer and its effort to provide 'integrated solutions' through creation of alliances was evident in vegetables much before the latest period when Bayer is again thinking to invest in vegetable R&D. Company reports on different vegetables reveal some interesting insights. For example, in 2008 Bayer entered into collaboration with the Aditya Birla Group, for marketing of okra; the seeds of the BASF subsidiary, Nunhems, were used for this Gujarat project, while the Bayer AG provided expertise and materials for crop protection (Bayer Crop Science, 2008). In 2012, it tied up with Bharti-Walmart for sale of vegetables in North India, again, with their own crop production strategies and Nunhems seed experts (Food Chain Partnership 2012). These projects started before Bayer Crop Science acquired Nunhems in 2014.

In fact, its seed business which was operating under the brand Nunhems, was under negotiation with BASF since 2017, and the deal was closed in 2019. The Nunhems R&D facility, under the Bayer Crop Science was also part of the merger with BASF. Through this deal BASF acquired 2600 varieties in 24 crops[24]. During the same period Bayer closed a deal with Monsanto, a company with the largest global vegetable seed business under the brand names, Seminis and Du Ruither (a Dutch company purchased by Bayer), in all these cases, for the expertise and flagship portfolio. Today Bayer competes with other transnational corporations to get a foothold in vegetable seeds, even while it remains the leader in agro chemicals.

24 www.nunhems.com/us/en/news_events/News/2018/180816_CW_EN_BASF-acquisition-Vegetable-Seeds.html accessed on 5 January 2022.

Profiling surveyed vegetable farmers

The exploratory field study in chemicals attempted to assess the Bayer's intervention in networking farmers, through interventions in both, seeds and agro chemicals. The field team surveyed 13 vegetable farmers growing cauliflower, green chilly, okra, long melon and potatoes. These farmers belong to different classes, and most of the medium and large farmers grew selected vegetable on only a small part of their landholdings in different seasons. As is evident from the table below, the total cropped area is only 50% of the total landholdings; only marginal farmers are growing vegetables on area that is almost equivalent to their landholding. As far as large and medium farmers are concerned, their land holdings may be larger than their cropped area. For example, one farmer only grows long melon on 0.61 hectares of land, out of about 15 hectares that he possesses. It is therefore evident, that vegetable farming provides subsidiary income to several farmers having lands. Another farmer, partly leasing and partly owning lands (with total access to about 32 hectares), grows Okra in about 6.07 hectares of the land. However, the same farmer also has sharecropping arrangements with women farmers, to whom he supplies inputs.

Table 3.3.7: Profile of Farmers by Size Class of Land and Tenancy Status
(Computed from Primary Data)

	SAMPLE SIZE	LAND IN HECTARE						REMARKS
		Possessed	Owned	Leased	Cropped	As percentage of Total		
						Owned	Cropped	
Operating Only on Leased Lands	**9**	**7.08**	**0**	**7.08**	**4.45**	**0**	**13.4**	
Marginal	5	2.83	0	2.83	2.02	0	6.1	
Small	4	4.25	0	4.25	2.43	0	7.3	
Operating Wholly Owned Lands	**3**	**43.70**	**43.70**	**0**	**22.46**	**85.7**	**68.1**	
Medium	1	7.28	7.28	0	0.61	14.2	1.8	
Large	2	36.42	36.42	0	21.85	71.4	66.3	One large farmer is operating only 0.61 hectares for Okra
Operating Partly Leased Partly Owned	**1**	**39.66**	**7.28**	**32.37**	**6.07**	**14.2**	**18.4**	Appears to be growing Okra on owned land
Medium	1	39.66	7.28	32.37	6.07	14.2	18.4	
Total	**13**	**90.44**	**50.98**	**39.45**	**32.98**			

Unlike the case of paddy, vegetable farming has diverse relations of production and the labour relations, all of which are structured to meet the needs of companies. Almost all farmers interviewed in Jamalpur, Faridpur and their surrounding villages were integrated into corporate networks, from both input and output side. As, we have indicated in earlier sections, the Bayer itself is collaborating with corporate vegetable marketing and processing chains in order to provide the farmers some incentive to buy their inputs. For example, it has recently tied up with Reliance Fresh for marketing of vegetables, retail giant LR for marketing of rice, PepsiCo for potatoes etc. Our field investigations reveal these patterns of vertical and horizontal integration in agricultural value systems.

Patterns of Pesticide and Seed Use

The survey of 13 vegetable farmers producing cauliflower, green chili, okra, potato and long melon reveals the following patterns of pesticide and seed usage. We focus on these two inputs because they have been penetrated by both domestic and transnational suppliers. The table below highlights the patterns of use of seeds and pesticides in production of different vegetable crops:

Table 3.3.8: Pesticides Used for Different Crops in Last Season (Field Survey)

CROP	SEED USED	COMPANY	AGRO-CHEMICAL USED	COMPANY
CAULIFLOWER	SYNGENTA 1522	SYNGENTA	EMISTAR	SYNGENTA
			TRACER	DOW
			DELEGATE	DOW
GREEN CHILLI	VNR 6013	UNNATI AGRO CHEMICALS	BAVASTIN	UPL
			JAMPRO	BASF
Okra	AVANTIKA	NATIONAL SEED	EMISTRO PRIME	BAYER
	NAVYA	UPL GOLDEN SEEDS	ANTRACOL	BAYER
	SYNGENTA 617	SYNGENTA	FAME	BAYER
			MELODU-DO	BAYER
			DECIS	BAYER
Potato	HIMSONA	BHAWANI SEEDS AND BIOTECH	EMRISTRO PRIME	BAYER
	CHIPSONA	BHAWANI SEEDS AND BIOTECH	MELODU DO	BAYER
	LR	BAJRANG FARMS	ANTRACOL	BAYER
LONG MELON	KANCHAN VNR	BHAWANI SEEDS	EMRISTRO PRIME	BAYER
			FAME	BAYER
			GAUCHO	BAYER
			AMIDA	BAYER

It is clear from the table that farmers growing cauliflower, who are mainly marginal and small landholders leasing-in lands, are largely integrated into input supply chains which are dominated by Bayer's competitor, Syngenta. Even in cases where farmers acknowledge the use of Bayer seeds, they do not report having used them in the last season. Only one large potato farmer from Jamalpur states that he would use Bayer seeds in the next season. In other vegetables like Green Chilly and Okra, seeds of large domestic companies were used by farmers. Field interviews suggest that farmers' have tried to use Bayer seeds in crops like okra and potatoes, but they stopped this because of the troubles they faced with companies like PepsiCo and Utkal who are the partners of Bayer who were buying their produce.

In Faridpur farmers brought Bayer chemicals from Reliance Fresh and their agents, who had collaboration with Bayer, even though they used seeds of a big national company, Bhawani Seeds[25]. As one farmer stated, he got Bayer inputs from the Utkal Company (a partner of Bayer) which had contracted him to produce potatoes. However, since farmers have had problems in receiving payments for their contracted produce from both PepsiCo and Utkal, they are not using their kits any more, over a large part of the area[26]. Rather they have started using kits of domestic potato seed companies (as reflected in the table). However, in many cases, the farmers still use Bayer pesticides in their crops. This interview reveals that the Bayer is dependent on its collaborating partners who provide forward linkages to contracted farmers; however, if the farmers find the arrangement unsatisfactory, they stop using this kit, even though their yields may have gone up. This could mean that the failure to implement Bayer's 'integrated solution' is due to its dependence on other partners to engage satisfactorily with the farmers in vegetable production.

In fact, there is only one case where a cauliflower farmer was partially using the seed and pesticide of the same company, i.e., Syngenta. Here too, the pesticide brands being used are of diverse companies, with Bayer being the dominant partner.

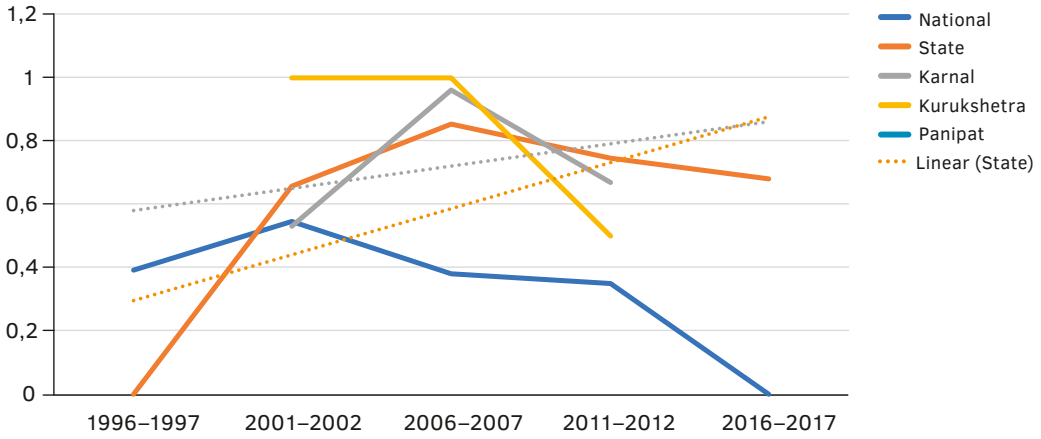
25 Interview Faridpur, 18 September 2021.

26 Interview at Jamalpur on 14 October 2021.

Intensity of Pesticide Use

Bayer seems to be on the road to making successful interventions in vegetables through increased sales of pesticides. Focus group discussions and individual farmers reveal that there has been a growing use of pesticides in vegetable production. Data from the input survey also reveals this and shows a rising trend of pesticide use at the state level, even though the national level use patterns show a declining trend.

Figure 3.3.4: Intensity of Use of Pesticides



At the national level the intensity of pesticide use came down from 0.54 to 0.34 between 2001 and 2012, this ratio was considerably higher for the state where intensity of pesticide use rose from 0.65 to 0.74 in the same period, decreasing to about 0.65 in 2016–2017. It is worth mentioning that this ratio was considerably higher for marginal and small farmers in 2016–2017, at 0.87 and 0.95 respectively. Our field survey has found that these farmers are largely growing cauliflower and green chilly. For larger farmers, chemicals is a substitute for human labour whose cost was rising considerably and the surveyed farmers also reveal that the use of multiple pesticides also reduces crop losses. This is reflected in the data on the number of pesticides used by these farmers:

Table 3.3.10: Crop wise Number of Chemicals Used and Length of Time (Field Survey)

CROP	NO OF CHEMICALS	NUMBER OF YEARS	SIZE CLASS OF FARMERS
CAULIFLOWER	3–5	5	Marginal and Small Farmers
GREEN CHILLY	4–5	4	Marginal and Small Farmers. One Medium farmer
Okra	8–10	8–10	Mainly semi-medium and medium farmers
Potato	8	12	Large farmer
LONG MELON	7	3	Large farmer

It is evident that the farmers depending on hired labour are prone to using more pesticides. For large and medium farmers, the use of chemicals and machines is also labour saving option. As the large potato farmer put it, "mechanization which included reapers and combine harvesters and the use of chemicals were the only way forward as it was necessary to replace labour, whose cost was going up". The farmer stated that labour got substituted by chemicals and was in favour of continuing high external input agriculture, even when he knew that there were issues with the use of pesticides[27]. This was repeated by medium size farmers from Faridpur who thought that the only way of maintaining and improving the yields of Okra were through use of chemicals promoted by private companies[28]. It is obvious, that such logic has profound implications for paid out costs.

Implications for Cost of Cultivation

The use of seeds and pesticides manufactured and marketed by domestic and transnational corporates has driven up the paid-up costs of all vegetable farmers in the region. Unlike paddy, where seeds were being procured and used from the agricultural extension system, here seeds are being accessed from company agents and traders. This drives up the cost of seeds and pesticides in almost all vegetable production:

27 Interview 14 October, 2021, Faridpur.

28 Interviews 18 September 2021.

Table 3.3.10: Proportion of Select Inputs in Total Paid Out Costs
(Computed from Primary Data, 2021)

CROP	SAMPLE	PERCENTAGE OF TOTAL PAID OUT COST						
		Seed	Fertiliser	Hired Labour	Hired / Owned Machine	Electricity & Irrigation	Insecticide / Pesticide	Lease Rent
CAULIFLOWER								
Wholly Leased in								
Marginal	4	12.71	7.20	11.41	6.37	1.19	26.08	35.03
Small	3	10.32	5.30	8.60	5.38	1.04	17.56	51.79
GREEN CHILLY								
Wholly Leased in								
Marginal	1	7.91	8.79	20.22	4.39	0.44	35.16	23.10
Small	1	8.51	5.67	16.07	4.73	0.47	37.91	24.84
Okra								
Wholly Owned								
Medium	1	29.81	8.63	21.95	0	3.14	32.95	0
Part Owned Part Leased								
Medium	1	24.30	5.47	16.28	27.21	2.43	24.30	0
Potato								
Wholly Owned								
Large	1	6.67	15.28	1.17	70.56	0.56	5.56	0
LONG MELON								
Wholly Owned								
Large	1	3.37	5.95	8.92	18.53	3.57	59.47	0

It is evident that cost of seeds and pesticides constitute a significant portion of the paid-out costs for at least three out five crops: in cauliflower they together about 30 and 27% for marginal and small farmers respectively. Significantly both these categories of farmers operate on wholly leased in lands, and the combined cost for marginal farmers is almost equivalent to their leased rent. In green chilli, (cultivated by farmers leasing-in lands), the pesticide cost is more than 35% of the paid-out costs, whereas in the case of okra the combined cost of seeds and pesticides is more than 50% (both these farmers own land, and one partly leases land). Pesticide costs are high in the case of large farmer producing long melon and potatoes. The case of potatoes is particularly interesting because the farmer uses pesticides and machinery to reduce labour costs. If the cost of running own machinery is added to the paid-out costs, it constitutes nearly 70% of the total cost. However, if it is taken out from these calculations, seeds and pesticides together constitute more than half the paid-out costs.

Large and medium farmers try to subsidise these costs through the use of government schemes and programmes. For example, two medium farmers in Faridpur and a large farmer in Jamalpur report the use government subsidies for buying reapers and harvesters in order to save labour costs[29]. They also oppose MGNREGS[30] because they think that it raises the cost of labour. Thus, farmers use subsidies to offset the costs accruing from integration into corporate input supply networks, especially with respect to seeds and pesticides. We may note here that all classes of farmers make some surplus income in vegetable production, however only if we exclude the impute costs of family labour, own land rent and cost of running own machines. In other words, any perceived profit from vegetable production is based on self-exploitation.

These results are corroborated by a study done in Karnal by some scientists of Indian Council of Agricultural Research in 2019, in the district of Karnal. Their data shows that about half the small cauliflower growers found the cost of seeds and fertilisers and about 60% found the cost of pesticides too high for any sustainable income. In contrast only a fifth of the large and a fourth of the medium farmers found the same cost too high. The same is true of Potato growers also where about 70% of the surveyed small farmers found prices of seeds and pesticides on the steeper side. About a third of all farmers found delayed payments by traders or contracted companies as a main constraint in production and marketing (Kumar, et al. 2019).

It is therefore not surprising, as shown by our survey, that ten out of the thirteen farmers surveyed, take advances or credit from traders in order and sell their produce to the same trader; most of them are marginal and small farmers. In such a case, their dependence on traders and contracted companies increases significantly and they use the inputs supplied to them by these intermediaries. As in the case of paddy, the in vegetables too, the companies rely on intermediaries for product penetration.

Health risks for small and medium farmers:

Except for one potato farmer, no other vegetable grower uses sprayers for pesticide use. Since most of them are small and marginal farmers, almost all are exposed to the impact of repeated pesticide use.

29 Interviews 18 September 2021 and 14 October 2021.

30 The Mahatma Gandhi Rural Employment Guarantee Scheme is a programme that provides 100 days of guaranteed employment to a rural family, who is below the poverty line. The workers are given minimum wage rates for the work that they do.

3.3.3 Case Study 3: Maize and Silage Production: A Case of Horizontal Integration

Bayer's interventions in Maize

As mentioned earlier, Bayer purchased its deal with Monsanto and acquired its seed business. Of these the Dekalb corn seeds were one of the most popular genetically modified seeds promoted by Monsanto. The Dekalb seed company was acquired by Monsanto in 1998, and its ownership was transferred to Bayer in 2017. Dekalb corn seeds were marketed in India pre-purchase, and its projects were implemented in partnership with state governments. In 2011, a high yielding variety of Dekalb seed 9108 was promoted for growth of spring maize that was used to prepare silage for dairy farming. In 2016, Bayer tied up with Nestle at the global level to promote its seeds for higher and nutritious fodder. Our case study focuses on the preparation of silage through use of Bayer seeds and pesticides.

Case of Silage-Dairy Farming Interface in Singhra Village[31]

The third case study, on maize cultivation and silage, was done through an interview with one a farmer from Singhra village, who also owns a dairy enterprise. He is one of the largest farmers surveyed in our field study and owns about 200 acres (80 hectares) of land, on which he grows paddy, potato and maize. He sows maize in spring, in about 32 hectares of land, and prepares his own pit for preparation of silage. For this, he purchases Bayer's Dekalb 9108 maize seed; in kharif season he sows about 31 hectares of Syngenta's 1844 corn seed for silage. It is clear, that he needs to produce silage throughout the year to keep its dairy business profitable. He owns four hundred cattle, which he maintains for dairy business; he possesses a chilling machine and other infrastructure for supplying milk to different vendors.

This farmer has been making silage for his own use since 2002, through Israeli techniques. However, the Dekalb seed was promoted by the National Dairy Research Institute (NDRI) after field trials for four to five years; it was claimed that Dekalb improved the nutritional value of maize. The dairy studied here was one of the earliest farms to use these seeds in Haryana. The difference between the earlier silage and silage produced from Dekalb was that the silage was not only more nutritious, but it could also be packaged and preserved for a longer time. Thus, while the silage was earlier use for only own consumption, the silage prepared by the Bayer seed and new technique (using own mincer and machine) is a saleable commodity. The farmer has his own pit and is able to produce silage for his own dairy and others. The seeds

31 Based on interview conducted at Singhra village, Nissin, Karnal 27 August 2021.

and pesticides are bought in a package from the Company's agent and the cost comes to about INR 15000 per acre or about 34000 per hectare, of which about INR 9500 is the cost of the seeds. Treated seeds are costlier than untreated seeds, and the farmer If the farmer, chooses to buy seeds and pesticides of different companies, then the "per acre" average cost is higher by about INR 500–700 (1200–1500 per hectare). The cost of production of one quintal of silage is about INR 600, but if farmers increase the production to five quintals, the same comes down to about INR 550; this difference occurs because of economies of scale in packing costs. The farmer employs 40 workers for animal husbandry alone: i.e., one worker for 10 animals.

Large farmers, with similar businesses achieve economies of scale by production of silage for themselves and others. While, the interviewed farmer uses silage prepared from his own crop for animals in his farm, he, along with other larger farmers he also purchases maize from about smaller farmers for producing additional silage which is sold at Rs. 6 per kg within a radius of 15 km; a big animal consumes 20 kg of silage a day. Middle and smaller farmers producing maize for larger farms, are expected to use the same pesticide-seed packages as them, so that the milk produced, is of the same quality. In such cases larger farmers act as aggregators for either companies like Nestle, or for local dairies, to whom they seil produce in cities like Delhi or Greater Noida, where they get a slightly higher price than what is offered by companies like Nestle.

Our informant tells us that many large farms and dairies also own their own chiller machines and offer testing facilities, which are also used by companies like Nestle. The account of large farm and dairy owners also show the contradictory relationship with Nestle; many large farmers are designated 'Nestle farmers', who get a discount on the Bayer seed because of their association with the company. So even though there is no explicit agreement with 'Nestle', clearly the Nestle prefers to buy milk from those who are using silage produced from the Bayer seed maize. In this region, Nestle has 1500 small farmers and 110 large farmers associated with them, they all use Bayer products, with regard to maize. Thus, large farmers, like our informant, have emerged as contact points for dairy corporates, and also provide infrastructure for local monitoring of fat and milk quality. But many such farmers also prefer to maintain some autonomous space vis-à-vis companies like Nestle, by selling milk to alternative sources independently; they use companies like Nestle, as fall-back options.

In Singhra maize farmers use Bayer pesticides like Gaucho, Solomon, Fame and Antracol in maize production. Like many other farmers, this informant also confirms that the use of Bayer agro chemicals is excessive, and such a use is controlled and promoted by the company itself. Since Bayer provides the seed, it also knows to which disease the crop will be vulnerable, and thus also provides the pesticide for the same in its package. Further, the company has no system of gathering data regarding the impact, success or failure of its seed and pesticide. Hence, its method of sale and promotion is not based on any scientific method or the continuous gathering of data. Focus group discussion with farmers introduced to us

by this informant also state that, prescriptions for use of pesticides are given by untrained representatives of companies and farmers are not given adequate information. Agents of the company also mix genuine chemicals with fake ones to increase their profits.

The preceding discussion has shown how Bayer's interventions in corn and silage have integrated, both maize producers and dairy farmers with agribusiness. This could be seen as a systemic change where large farmers, been acting as aggregators and provided a pathway to link smaller farmers with the larger value system. Our study reveals that there are at least 15-16 large dairy farmers like him in the region, and these farmers possess the infrastructure and capacity to exercise some autonomy from agri-businesses. This increases the dependence of small and medium farmers,on both, companies and large farmers. Hence a systemic and horizontal integration is taking place.

3.4 Labour, Occupational Health and Pesticide Use

One of the important aspects of the impact of patterns of integration is on the occupational health of the farmers (Scherrer and Radon 2019, Jha, Singh and Sharma 2019). This is also indicated in the case studies, with the rise in pesticide consumption in Karnal, there is also the problem arising out of lack of attention by Bayer to the impact on occupational health of the sprayer and small farmer. Even though the company claims that it is taking care of biosafety measures, our focus group interviews suggest otherwise. In this sub-section we discuss these issues.

Bayer's Intervention on Safety

Bayer's own reporting reflects its projection of the awareness of the risks of pesticide use. This is seen in the corporate reporting of Bayer Global and Bayer Crop Science India. "Agrochemical products have a high tendency of being toxic and when stored in bulk storage systems may pose significant environmental risks. We have been following rigorous quality control mechanism and disposal process to minimize the impact of waste generated from our manufacturing units. By putting more efforts, we have been measuring and monitoring toxicity of several effluents in waste water generated and affirm that they are way below the legal limits. We ensure all the legal requirements are met with respect to generation, packing, storage and disposal of hazardous and biomedical waste too". (Bayer Crop Science India 2019, 75)

The report underlines compliance with all regulations of the Indian Central Pollution Control Board and State Pollution Control Board, and a track record of "zero show cause notices". This section is followed by a listing of awards received by the subsidiary for its "commitment to protect and preserve our environment and communities" (Bayer Crop Science India 2019, 75) . Thus, the subsidiary's reported activities with respect to environmental impacts mainly

apply to its manufacturing units, and most of the examples mentioned are not quantifiable in terms of location, time or money spent. Environmental health, especially linked to safe working conditions for the customers (i.e., farmers and workers) is not reported in this section. The idea of "health" is mostly related to the subsidiary's own employees, e.g., in terms of company health plans, or activities that could be largely summarized as "corporate social responsibility" outside the core business of crop science.

The concern for occupational health of the users of the company's products is reflected in its assurances of "product stewardship", "safe handling" and "safe / responsible use", in both the global and Indian corporate reporting. Observation of the FAO's Code of Conduct on Pesticide Management is stated, which "cover the entire life cycle of a product or technology, from its development to its application and beyond" (Bayer Crop Science India 2021, 104). "Safe Use Trainings" by the company include trainings given to reported numbers of farmers, dealers, Bayer staff and others, on the use of the products and personal protection equipment. The Indian subsidiary distributed about 8,000 protection kits and 750,000 face masks in the context of the pandemic, but it is not evident from the reporting whether the distribution of protection kits is a regular and free feature of its products' sales. Given that the Company claims that there are 20 million smallholder farmers that it has networked in India, the number of protection kits appears to be small. In addition, the distribution of these kits seems to be an emergency measure to cushion the impacts of the pandemic. In the adjacent paragraph of the same section, the subsidiary reports 66 pending cases of customer complaints as of March 2021, without specifying their reasons, origins and resolution. From an occupational health perspective, this leaves reporting gaps, given the well-known and inherent hazards of pesticides.

It appears that the reporting aims at building the argument that a safe use of pesticides is possible after training and awareness campaigns are done, and directions of use are given on the labels (Bayer Crop Science India 2019, 78). In many cases, the word "safe" is accompanied by or replaced with the word "responsible". In the "Bayer Safe Use Ambassador" program, students of State Agriculture Universities "educate" farmers' families about "responsible use" in their villages and homes, suggesting that the responsibility rests with the users while the marketing and sale of the products are generally uncritical (Bayer Crop Science India 2019, 78). In a few cases, the problem of over dosage is addressed marginally. The solution provided are packaging sizes equal to dosages and measuring cups (Bayer Crop Science India 2021, 92). Similarly, product-related pollution is associated with "unhealthy reuse of discarded bags and containers" and the counterfeiting of products for which the company suggests that it has its own waste collection service, and a product code verification helpline (Bayer India Annual Report 20–21).

Bayer Crop Science's Annual Reports include reporting on safety measures taken by them with respect to safe use of pesticides. They repeatedly give instances of holding trainings and distributing PPE Kits with knowledge of how to use pesticides with precaution. As per its reports, Bayer holds three kinds of dissemination programmes; 1) those solely dedicated to safety issues, 2) those embedded in their larger outreach programme and 3) those held jointly with universities, research institutes etc. The claim is that they orient and train, both staff and farmers for this purpose. The three-year progress of their trainings is reported as below:

Table 3.4.1: Progress of Training on Safe Use of Chemicals, 2018–2020

YEARS / TYPE OF TRAINING	NUMBERS TRAINED			
	Staff	**Farmers**	**Dealers**	**Others**
2018–19				
Dedicated	140	8180	425	1845
Embedded		382500	935	4040
Joint		96000	820	1105
2019–20				
Dedicated	290	8280	580	2100
Embedded		408000	1070	3600
Joint		98000	830	1340

The table above highlights tall claims about the safety measures undertaken by Bayer, but even the company's data excludes the sprayers altogether from the scope of training programmes undertaken by Bayer in 2018–19 and 2019–20. Further, our case studies too have confirmed and shown that farmers and traders are unaware of safety measures.

Focus group discussions with Sprayers[32]

While it is evident that marginal and small farmers are still bearing the brunt of the effect of spraying chemicals in their own fields, there is also a class of agricultural workers who spray chemicals on the crops of medium and large farmers and are suffering from the consequences of promotion of irrational and unsafe use of pesticides. There are close to 10000 agricultural workers specializing in pesticide spraying and application in the three districts of Karnal zone and focus group discussions were held with them during several field visits. Discussions on conditions of work reveal that male sprayers of pesticides on paddy and vegetables were long-time residents of the district and have been undertaking this work for more than a decade. Conversations occurred with the wives of the sprayers because husbands could not

32 The narratives of this sub-section are based on focus group discussions between field team and farmers and field reports of field team synthesized in the Hindi field report submitted by Rajinder Singh and Field report prepared by Dinesh Abrol for Field Visit of 20 October 2021 and 18 September 2021.

participate by themselves in the meeting organized by the field team. Among the participants there were fifteen female participants who also identified themselves as agricultural workers undertaking jobs in the farmers' fields as daily wage workers. They get paid at an average wage of Rs. 200 to 250 per acre. Due to mechanization and use of agro chemicals the number of working days for agricultural work is declining and their wages continue to be low. Among the participants there were also women workers from the families of these workers undertaking agricultural work. Four the people in the group identified themselves as the wives of sprayers who could not come and were bedridden on account of the ill effects of the ingestion of agro chemicals. Like others these male workers were spraying agro chemicals in the fields without wearing personal protection equipment (masks and aprons). Their spray tanks are old and are in need of repair / renewal. As they have no support from the companies / traders or the government / department side this risky activity goes unchecked and has been continuing over a long period of time, making their long-standing practice unsafe and unscientific. This makes their long-standing practice unsafe and unscientific.

It was clear from the interaction held with them that both farmers and agricultural workers need to learn far more about the use of pesticides. Companies, traders and distributors do not actively teach about the precautions to be followed with regard to pesticide applications and required safe which farmers and workers need to follow leading to injuries and even criminally liable due to harm being done to the health and life of sprayers. Several stories of premature deaths were shared by the sprayers and their family members. The news of death of two sprayers who died in September 2021 and which had appeared in the local press whose clippings made available to the project team.

The sprayers continued to undertake intenstive spraying work in the Kharif season of 2021, because 70 percent of the rice cropped area of Kamal was affected by white back plant hopper and sheath blight on account of cloudy weather. Sprayers are known to spray potent chemicals to treat the pest ridden paddy without any precaution for a considerable period without rest. Their wages are not enough to maintain the minimum nutrition levels, and therefore is not surprising that they are becoming a prey to insecticide poisons. Insecticide manufacturers and concerned departments of agriculture and labour have not taken interest to organize regularly training for sprayers, and farmers. Many workers among the sprayers who are suffering from insecticide injuries have no medical help and are practicing self-medication. They treat themselves at home and cannot afford medical reatment or undertake rest because of the fear of losing their wages.

We learnt that sprayers choose to go to public hospitals only when they experience the symptoms of acute poisoning; they have been learning from each other to deal with the injuries. We also learnt that they do not stop stopped working and continue to work despite illness. Most of the affected sprayers have been undertaking working on a regular basis, despite the awareness that their injuries occur due to their occupation. This conditions arises out of their structural position as they are migrants and landless; and some of the poorest persons of the village. Therefore, poor working conditions continue; sprayers also suffer from regular episodes of unemployment, implying no work, no wages and no food for the family members.

Armed with this knowledge and information gained from the focus group discussions now the Haryana Vigyan Manch (HVM) is in the process of organizing sprayers on this very issue. The state government officials have been apprised of the problem. There is the need to take quick action to save the lives and health of poor agriculture labourers. They have also visited by now the village Sadarpur where the worker who died lived. We have the press clippings of the visit made to this village by the field team.

The HVM[33] has demanded that the government should support the sprayers with a group insurance scheme. It has demanded that the government should organize and pay compensation of Rupees twenty lakh to the affected families of sprayers who died this season. It has demanded that the government should undertake steps to get the sprayers safe application equipment and personal protection kit by the next season. It has asked for the establishment of a dedicated unit at the public hospital to provide treatment and health education to the sprayers. It has demanded that all the companies, be foreign or domestic, should cooperate with the government to build a data base on the transactions involving the sale of pesticides to farmers and sprayers. The record of transactions should be uploaded by them on a daily basis. The government should make the record keeping and sharing of data with the government on sale transactions compulsory. It has demanded that the spraying of pesticides by drones is not a good solution to the problem of either residues persistence or the environmental and occupational health of farmers, sprayers and citizens affected by irrational use of pesticides. The HVM is demanding the implementation of integrated pest management and the provision of regular training of sprayers and farmers on the issues of crop protection.

33 The demands were formulated in the feedback workshop on 17 December 2021, which was largely attended by sprayers and farmers.

4 Growing Power of Corporate Agribusiness and the Challenge for Indian State

This concluding section brings together the insights on the material basis, and forms of expression of corporate power in order to draw out the broader conclusions of the field study. The case studies analysed above provide us with some important insights into the growing power of Bayer and its collaborators. They also give some understanding of the implications of the growing penetration of agribusinesses and their 'integrated solutions'. The growing power of transnational companies is on account of the withdrawal of the State, and has led to an enhancement of their structural power. This power asymmetry is also reflected in the hegemonic influence which propagates the idea of indispensability of pesticides, accepted now by all actors associated in the GAVS. The study illustrates that there have been significant economic, environmental and health impacts on all classes of farmers, particularly marginal and small farmers in this green revolution region. Here we explore, the legitimating discourse and display of 'discursive power' by Bayer on the one hand, and the material conditions of growth of corporate power on the other hand.

4.1 Expressions of Growing Corporate Hegemony through Display of Discursive Power

As seen in the preceding discussion, the discourse of "tailored solutions" is supported by industry alliances, and corporate reporting about corporate product stewardship, occupational health, and actual usage patterns in the fields. The gaps between the findings in the field and corporate reporting are not uprising insofar as the corporate reporting will obviously focus on positive aspects and justify any contested issues with the help of skilled public relations and auditors (Michelon, Pilonato and Ricceri 2015, Hahn and Lulfs 2014, Bouten, et al. 2011). However, our analysis has compared corporate reporting with results emerging from real life analysis and indicated discrepancies emerging from such analysis.

The products sold and used in the region differ from the reported marketing strategy of "tailored solutions" which put emphasis on a service component along with product sales, in many cases facilitated through alliances with digital service providers, insurance companies or banks. "Tailored solutions" as they are presented in the corporate reporting imply a more targeted and economical use of pesticides. According to the numerous interactions with producers, logistic personnel and sales agents, the actual marketing taking place in Karnal follows a simpler strategy where corporate power is analysed through traders and commission agents, rather than through direct sales to farmers. Though, the company has 'nodal officers', it is evident that the traders play a greater role than the 'field officers'.

This sales model of a constant flow of a broad range of pesticides is mirrored in our second finding, i.e., evidence on largely unguided pesticide use, pest resistances and subsequent multiple applications of various pesticides threatening the health of farmers, workers and the environment. Researchers, practitioners and activists have referred to this as "treadmill impact of pesticide use" which actually puts producers in a position in which they apply different pesticides one after the other for one pest problem. The observations and statements collected in the field give rise to the impression that a certain conditioning of farmers has already taken place, making them loyal customers due to the lack of alternatives. Meanwhile, the product stewardship of the multinational does not extend beyond its products registrations, a conclusion supported by the lack of corporate reporting about concrete grievance and redress mechanisms for the final users of the products. In addition, field findings suggest that besides keeping farmers' contact data, sales representatives do not collect feedback data on input application patterns, pest resistances and farmers' experiences with the products. Similarly, the researchers' informants could not see any structured feedback collection on pesticides' impacts in the area.

As we make sense of the findings from the perspective of producers, or from a non-corporate perspective in general, we conclude that in the current regulatory environment, the multinational can bank on its discursive power by reproducing the notion of input-centered agriculture without alternatives. This is especially true in markets where public extension services have been weakened and consumer protection and regulatory supervision are insufficient. One common thread that we found both in the intensive discussions with people in Karnal and the analysis of the strategic documents of the company is the discursive power that sustains the situation on the ground. The observed "pesticide treadmill" can only be maintained through the combined effect of company representatives promoting the sales of pesticides and associated advisory, while government services are in retreat and have opened a vacuum to be filled by both multinational and domestic input companies.

Fuchs (Fuchs 2005) writes that multinationals "are increasingly exercising discursive power by actively participating in public debates on the definition of political problems and solutions as well as offensively and defensively shaping their image as economic, political, and societal actors" (p.2) In particular, this dimension of power serves to "influence policies and the political process as such through the shaping of norms and ideas" (Fuchs 2005, 21). Bull et al. (2021), analyzing different forms of corporate power applied in international investment agreements in the food sector, with examples from Monsanto, Mahyco, and Syngenta, define discursive power as "ideational aspects of power that create, shape, and silence discourse and conversations around corporate actors". Their definition acknowledges the possibility of multinationals reproducing narratives, e.g., on the safety and necessity of their product service portfolio, in order to legitimize their further inclusion in public policy and other forms of governance.

Researchers applying power dimensions based on Fuchs (2005) emphasize the mutually enforcing character of discursive power and other forms of power ((Clapp and Fuchs 2009, Fuchs 2005, Bull, Plahe and Gregory 2021)). Some aspects of this were discussed in the foregoing analysis.

4.2 The Material Basis of Growing Corporate Power and the Indian State

The discourse of 'integrated solutions', as field our field study shows, is not only a legitimating trope, but is embedded in horizontal and vertical integration arrangements, after the implementation of neoliberal policies. With the withdrawal of the State from extension, R&D, production, procurement etc., the company is now in a much better position to create its hegemony through the exercise innovation and demonstration power. Through this process it also augments its own structural and bargaining power vis-à-vis the farmers of all size classes, thereby intensifying the process of accumulation. Macro level structural shifts, discussed briefly in Section 1, provide a broader context to the case study of the impact of the integrated solutions that are promoted by Bayer Crop Science in India.

The study indicates how the hegemonic influence (and consequently demonstration / discursive power) of Bayer and other transnational companies has been growing because of neoliberal policies which have unleashed social and political processes that have induced modification of beliefs, attitudes and views of all actors across the GAVS, i.e., the business groups, intelligentsia associated with S&T, and media professionals who are capable of influencing public opinion. This shift in the balance of power, in favour of corporate players, has also affected changes in the nature of interdependence and links / connections and relations. Field studies indicate that Bayer Crop Science targets traders, food retailers and processors as nodes for procuring high-quality and uniform produce. The company also makes a claim of providing continuous supply of healthy and nutritious food to consumers through collaborations with other corporate houses and large traders / exporters. However, it has no mechanism for the getting feedback and monitoring from different actors within the system. In such a case the promotion of 'integrates solutions' does not appear to be a method of promoting 'sustainable development' or healthy food habits, as claimed by the company.

Section 1 and 2 of this paper have indicated that Bayer's hegemonic discourse of 'integrated solutions' is a result of mergers and acquisitions, particularly with Monsanto-Mahyco, with whom the integration has only been completed in 2020. Hence, the full impact of Bayer's strategies is yet to unfold and would have to be the subject of further research. Any evaluation of Bayer's 'integrated solutions' has to be contextualized in its capacity to augment its R & D, innovation and out reach capacity through the use of its financial heft and market power. Seen in this context, our study of 'integrated solutions' is an attempt to unravel the complex layers, of the systemic changes that are affected by patterns of horizontal and vertical integration that are affected through this process. Thus, we see the method of the creation of a hegemonic discourse, which facilitates patterns of vertical and horizontal integration with global capital.

Diverse indications and trends of integration into GAVS

As analysed in Section 1, the GAVS consists of complex, asymmetrical relations of vertical and horizontal integration. The manifestation of these patterns of integration may vary in terms of its form whose form and impact with respect to different sections of the peasantry, and also within different cropping systems. A comparative analysis of insights provided by the illustrations in the preceding part of this sub-section can be summarized in the tables below:

Table 4.2.1: Cropping System Wise Comparison of Patterns of Integration

FORMS OF INTEGRATION	PADDY	VEGETABLES	MAIZE	IMPLICATION FOR SMALL AND MARGINAL FARMERS
Vertical integration through pesticides promotion and use	traders/ commission agents	traders/ commission agents	traders/ commission agents	Rising use of pesticides and share in total cost
Vertical integration through seeds	Public sector still present	Indian and MNC corporates, Bayer-Seminis integration new development post-merger	Post-merger seed and pesticide domination	
Role of Large Farmer important	Rising cost of seeds in vegetables and maize in addition to pesticide cost			
Bayer's strategy of horizontal integration with other corporations and domestic businesses	Tie ups with KRBL, LT, FMC, Big Bazaar, and other local companies	PepsiCo, Utkal, Reliance Fresh, Mother Dairy and others	With Nestle	Rising dependence on larger farmers and traders

Table 4.2.2: Class, Integration and Implications of Rising Cost of Production

ASPECTS	MARGINAL (< 1 HA)	SMALL (1–2 HA)	SEMI-MEDIUM (2–4 HA)	MEDIUM (4–10 HA)	LARGE (> 10 HA)
Labour	Higher use of family labour	Dependence on women's labour	Some use of hired labour	Use for of hired labour for some operations	Minimum use of labour
Machine	Minimum use of hired machines	Higher use of hired machines	Mainly use of own machine	Increased Use of own machine	Largely use of own machines
Spraying of chemicals	Spray own chemicals	Spray own chemicals	Use hired agricultural labour	Use hired agricultural labour	Use hired agricultural labour

Both the tables indicate that the small and marginal farmers have felt a disproportionate impact of their integration into the GAVs. As is evident from the case studies, most marginal farmers are those who have now leased-in land in order to undertake cultivation. This means that their costs of cultivation are considerably higher, and they are forced to grow crops that have an assured market through the large farmer or trader. In such cases, both large farmers and traders become the nodes integration of marginal / small farmers into GAVSs.

The hegemonic influence of Bayer has been evident in the manner in which scientists, policy makers, traders and commission agents have succeeded in convincing the farmers that there is no alternative to chemical synthetic pesticides. Earlier there was an alternative in integrated pesticide management (IPM) under discussion within the country. It has effectively disappeared from the discourse on agriculture in India. The absence of the counter veiling power of the Indian State and the lack of promotion of alternatives to use of chemical synthetic pesticides to the farmers is a key contributory factor which is perpetuating the dominance of big domestic and transnational agribusinesses in the field of crop protection.

In the case of paddy seeds, where choices are available through the government system, even big domestic businesses like KRBL, is selling Pusa seeds, as a part of the Food Chain Partnership instituted by Bayer. It is clear that demonstrative / innovation power makes a difference. Integrated pest management (IPM) survives and exists in the select corridors of Pusa Institute, Directorate of Plant Protection and some universities. The adaptation of innovations to the social reality, and demonstrative capabilities of social forces which would support such an initiative are missing, or at best limited, in the case of alternative methods of pest management.

Impact on Pesticide Use and Labour

Bayer's growing demonstrative power is strengthened by the weakening of the Indian State's agricultural extension system. Farmers in all three cases expressed concern with regard to the weakening of the innovation and demonstration power of the Indian State. Farmers across different classes suggested that pesticide companies are not employing qualified staff and are relying on input dealers to push the products, thereby becoming the nodes of vertical and horizontal integration through interlocking of input and credit markets. Commission (company) agents determine the dissemination and farmer's use of pesticides. Apart, from recruiting village level field staff to disseminate information, an important method of market domination is the creation of company propaganda and technology. The field officers provide a nodal support to the farmers and disseminate the information provided by the company in order to create their own hegemony in the field, termed as a 'demand and brand creation' exercise by the company. The field officers are provided audio visual and other materials by the company.

Field studies also show that the recommendations made on the calendar of sprays schedule and curative and pre-emergence treatments are not even applied religiously and good enough to contain the problem. There are indications of the pervasiveness of pesticide treadmill effect in the area of study. All our case studies have illustrated that farmers use multiple pesticides / insecticides and a key driver for this pattern of use is the growing pest resistance to pesticides, shortening the time span of pesticide effectiveness. Broad spectrum insecticides, such as Native, Regent and Fame (used across crops and classes of farmers), reduce natural enemy populations and disrupt biological control. This creates an increased dependence on insecticides, which reduces natural enemy populations even further. Hence, positive feedback is created in which a farmer increasingly relies on chemical pest control while simultaneously, biological control is weakened.

The said process has been referred to as the pesticide treadmill, in which farmers increasingly keep using insecticides and companies keep introducing the use of more and newer products to solve a pest problem. Herbicides are also coming to experience a treadmill effect. This makes it harder to return to a pesticide independent farming system. The pesticide treadmill effect in Karnal means overuse of pesticides with frequent applications, higher dosages and the use of a limited range of mode of actions (MoAs) and Active Ingredients (AIs), ultimately decreasing pesticide effectiveness through resistance development. Confirmation of this preliminary conclusion can be seen from the analysis of evidence in making in the case of Karnal.

The exploratory study suggests that the system of farming in place for the production of rice, wheat, maize and vegetables has no place for incorporating the criteria of multifunctional agro-ecological integration in the solutions under implementation by Bayer. Hence, Bayer's claims of promoting 'integrated solutions' in the name of Sustainable Farming practices seems to be a clear strategy of incorporation of chemicals and seeds suitable for corporate domination; for example, maize variety under promotion used the seeds of Bayer because the variety gave more grains compared to biomass. This comparative advantage has led to a treadmill impact, which is actively propelled by different types of horizontal and vertical arrangements between domestic businesses and transnational companies like Bayer.

Growing Dependencies of Farmers on Corporate Sector

The case studies point out that the rising of cost of production is driven by the increasing costs of pesticides and land rents. In case of vegetables and maize, farmers pointed out that their costs of seeds had increased over time, especially with the marketing of input kits by agencies and companies who had tied up with companies such as Bayer and Sygenta for the supply of inputs. In such a situation farmers see the reduction of labour costs as a viable way of saving the hassle to manage and discipline rural labour. Synthetic pesticides act quickly to reduce pest populations and suit the farmers better to meet their current economic challenges. Farmers, across different classes indicate that pesticides provided by Bayer and other companies are relatively easy to use and can be applied with even limited information about the agricultural ecosystem.

One of the central consequences of the treadmill impact, and the patterns of integration sustaining this impact, is the adverse impact on farmers' livelihoods and health. The case studies illustrate that, though farmers of all size classes are experiencing income squeeze, its impact is much harsher on marginal and small farmers. In paddy, the treadmill impact of pesticide use has resulted in severe losses for such farmers, especially because they do not own assets like own machinery and land. For farmers leasing-in lands, the squeeze is even higher. In vegetables and maize too, dependency of all farmers on corporate oriented inputs is on the rise. While large farmers offset their vegetable production with a process of diversification, for small and marginal farmers, patterns of diversification are limited and therefore cannot cushion precarious incomes. As the case studies show, while medium and large farmers with running into problems with input kits and buyers can afford to exercise choice and make the best use of inter-corporate rivalries within input and output markets.

But the same relative autonomy does not exist for marginal and small farmers. This is also reflected in the case study of agriculture-dairy interface in the maize silage study. Here, the smaller farmers are also dependent on larger farmers for inputs and markets. This case indicates that very large farmers not only exercise certain autonomy, but are also becoming nodes of vertical and horizontal integration in select cases. Thus, we can conclude that the dependence of marginal and small farmers appears to be growing and their vulnerabilities will only grow with this.

Such growing dependencies have uneven impacts on different classes of farmers. The exploratory study highlights that the marginal and small farmers face the challenges of occupational health to a greater extent. In all three cases, it is evident that this class of farmers sprays their own pesticides. Medium and large farmers employ sprayers, but these are largely landless. Hence, the agricultural workers are also impacted by increasing use of agro chemicals. Another unintended consequence, as mentioned earlier, is the loss of work by agricultural labour, particularly women, because of the substitution of labour by machinery and pesticides

Beyond Farmers: Impact on the Agro-Food System

In quantitative terms, on average, India's rate of application pesticides is low, but uncontrolled and haphazard usage is responsible for the presence of residues in both natural and physical environment[34]. Commonly used pesticides include insecticides, fungicides and herbicides for management of uncontrolled weeds and pests in agriculture, with insecticides having the highest share of all pesticide use in India. Presence of pesticide residue in irrigation water is an important problem for Haryana. Mishra et al. (2019) show that water samples extracted from Haryana and tested for pesticides show contamination[35]. Not only that all of these issues are occurring in abundance in the field, feedback from the field team on these issues is that there is fear of corporate domination among the farmers and the main issues and

34 Several studies have reported that the pesticide application is indiscriminate and beyond safe limits (Dey 2016). In Rangareddy district, Andhra Pradesh, India, a study conducted in 2007, pesticide residues were found in the vegetables like okra, tomato, cucumber, brinjal, etc. and also in the collected water samples from Kothapally Adarsha watershed. Chlorpyrifos and cypermethrin residues were above the limit in 59, 4 and 2 samples, respectively in the water samples taken from the area (Rao, et al. 2009).

35 Results clearly point out the problem; of total 112 water samples tested, 70 were contaminated with pesticide residues. Samples were found contaminated with Malathion, Chlorpyrifos, and O P DDE. Pretilachlor, Butachlor, Atrazine and Trizophos with concentration range 0.044–0.079 mg/kg, 0.01–0.10 mg/kg, 0.07 mg/kg, 0.012–0.91 mg/kg, 0.012–0.91 mg/kg respectively (Mishra, et al. 2019). There are studies on the occurrence of the cancer and other life-threatening ailments due to contaminated water with heavy metals and pesticides. A high risk of DNA damage due to pesticide exposure has been observed by the study undertaken on Malwa region of Punjab (Mittal, Kaur and Vishwakarma 2014, Thakur, et al. 2020). According to Pesticide Action Network (PAN), a total of 85 pesticides registered for use in India are banned in other parts of world.

concerns arising from the fear from corporate domination are real. The evolving mechanisms of corporate domination in making would need further exploration. Future studies to be undertaken in the field with the sprayers, farmers and the other partners of input suppliers such as Nestle, LT, Reliance and their closely associated trading system have been identified for follow up by the field team.

There were accounts from farmers of how the cost of pesticides to be purchased has grown manifold over the period of last two decades. Interaction with Bayer Crop Science company staff and distributors yielded the standard narrative claiming that Bayer's "integrated solutions" will result in more efficient use of resources, and thus improve sustainability. Bayer, Syngenta, Dupont, Monsanto and other R&D companies (as they are also understood by farmers) had the confidence of farmers, and farmers believed that their claims about the safety of products and application should be true. Government has approved their products. The focus of companies and farmers is obviously on the immediate outcomes, leading to pesticide overuse and a trap that reinforces the perils of high input agriculture and creates barriers for ecologically sustainable farming systems (Hu 2020, ICAR-Ministry of Agriculture and Farmers Welfare 2020).[36]

Resistance and the Power of Farmers and Labour Collectives for Reorganization of Production in Equitable Way

Collective action is yet to be undertaken at the ground for the benefit of this region by all the other actors including the Union government or the farmers' movements resisting the policy of liberalization of trade and investment. The pathway of deregulation of trade and investment is a major impediment. The pathway effectively places no obligation on the system trying to find good practical solution to the problem of environment, health and livelihoods. Certainly, for the society as a whole this silence of the agribusiness as a whole is a matter of concern. Farmers told the field team that we should do something concrete in this regard to change the situation, and they would be willing to cooperate. This holds true for the problems of soil health too in this region.

36 Due to the inability of farmers to come out of the trap of pesticides an unsustainable system of farming system is the ultimate outcome. As pointed out by Zhanping Hu (Hu 2020) such a trap is related to the build-up of pesticide dependence / pesticide overuse. As the exploratory study indicates, Bayer's integrated solutions, which are also promoted by other agribusinesses in the region, fall far short of the recommended solutions and are presently unable to offer any kind of effective succour to the farmers in the region. This is the case even when the urgency of the challenge of agro-ecological transformation of agricultural and food system has been finding some resonance within the farming community, research community as well as policy making community (ICAR-Ministry of Agriculture and Farmers Welfare 2020).

Alternatives evolving in cotton for crop protection in Jind are in contrast practicing the path of no to insecticides in cotton and rice. Jind is an adjacent district sandwiched between Hisar and Karnal, wherein cotton farmers have taken to dropping the use of insecticides to move towards the integration of environment and health. Although the analysis undertaken of outcomes of the focused group discussions has revealed that there is already some level of activity in the region due to the support from NABARD to a Farmers Producer Organization (FPO) working in Nilokheri block of Karnal district, and that there is now a project aimed at influencing the knowledge, attitude and practice of farmers of the region, but the problem requires an integrated solution because environment, health and livelihood need to be addressed collectively and cannot be tackled separately.[37]

In the Karnal zone, there exists on the ground much chaos and disorder. Corporates like Bayer-Monsanto, Syngenta-ChemChina, Dupont-Dow, BASF and some generic companies are the main beneficiaries of this order. This order benefits far more the input suppliers which include foreign agribusiness and generic companies largely domestic in origin. Benefits also accrue to a section of larger farmers who have the access to means of production (land) and capital. The resultant metabolic rift continues to widen because the social resistance to chemical control strategies causing loss of soil fertility, ecosystem services and pesticide treadmill effects is yet not in place. Certainly, this would need collective action from farmers and others.

In this study, the focus of the analysis is limited to examining the patterns of integration by the agribusiness supplying crop protection chemicals for the rice-wheat cropping system, maize production and vegetable cultivation. We have studied the efforts put in for the introduction of "integrated farm solutions" by Bayer in Karnal zone. Bayer is not only providing chemical inputs to farmers but also promoting simultaneously the integration of farmers with the companies working on post-harvest operations, marketing of produce and value addition. For example, Bayer has been trying to link the farmers with Nestle, LT, Pepsi, Utkal, Reliance, Adani and other such organizations active in food retail.

The study on Karnal Zone corroborates that the capital accumulation in the agro-food sector is characterized by: a) the redistribution of costs and benefits between farmers and agribusiness with the introduction and diffusion of incremental changes under the label of 'integrated farm solutions', b) the restructuring of markets for farm inputs and agricultural produce through state intervention in favour of transnational agribusiness, export orientation, contract farming and import dependence; and c) conversion of land from a means of production into an object of speculation with the expansion of cash tenancy, which has been facilitated among landless farmers by exporters, "agritech start-ups" and traders through Farmer Producer Organizations.

37 Field report, Gholpur Village, Nilokheri block, October 14, 2021.

Such organisations are used by corporate players for facilitating procurement of produce, retailing and processing. T hese objectives are promoted by the Indian government (Ministry of Agriculture 2017) and implemented in partnership with companies like the Bayer as indicated in Section 2.2.

Contributions required for the building farmer oriented systems of innovation are absent from the side of the input suppliers at the enterprise / corporate levels. People oriented integrated solutions are needed to develop the system of farming from Level O of no agro-ecological integration, to Level 5[38] which is marked by rebuilding the agro-food system to make it sustainable and equitable for all. If this area is to make any further progress with the upgrading of agricultural value systems, then it is clear that this will call for the input suppliers to responsibly deploy their enhanced bargaining, institutional, innovation and demonstration and discursive power for the introduction and diffusion of innovations. Monitoring of impacts of innovation should be done throu gh development of inclusive institutions and instruments which involve a collaboration between farmers and other relevant actors.

This new path will also entail the co-creation of knowledge with the active participation of cultivators and agricultural labourers who are ultimately the social carriers of innovations and transformations in the field, the state and market forces will have to promote and cultivate the collaboration between cultivators, labourers and consumers to induce the suppliers to develop a programme for the safe and productive methods of pest control in order to mitigate adverse impacts of pesticides on environment and human health. Participation of neighbourhood farmers is needed to implement biological pest control successfully. To be successful coordination and cooperation among farmers is required, which means that there should be collective action, contestation and shared understanding on the way forward among actors in the agricultural system, including farmer communities, agro-industry, governments and consumers.

38 Stephen Gliessman (2016) suggests evaluation of solutions in making based on the developments vis-a-vis the implementation of progressive food system transformation. Proposed five (5) levels of food system transformation are namely- Level 0: no agro-ecological integration; Level 1: increase efficiency of industrial inputs; Level 2: Redesign whole agro-ecosystems; Level 4: Re-establish connections between growers and consumers develop alternative food networks; Level 5: Rebuild the global food system, so that it is sustainable and equitable for all size classes of farmers, laborers and consumers.

5 Areas for Further Research

One of the main limitations of this study is that there is also the need to study the emerging barriers to crop rotation, crop diversification and balanced use of fertilizers on account of the integrated solutions of Bayer and many other companies. Agribusiness is also beginning to include for this region now in the integrated farm solutions the components of digital solutions and vegetable and maize seeds with intellectual property rights controlled by Bayer Monsanto, Syngenta-ChemChina and Dupont-Dow combines. Vegetable seed business is to a significant extent now for this region in the hands of Bayer-Monsanto combine, Syngenta -ChemChina combine and Dupont-Dow combine. A systematic assessment of these components could not be carried out in this four-month investigation.

This short-term exploratory study has provided some important insights into the need for further research into several questions, some of which are indicated here:

1. The contours of emerging GAVS: Though the study provides some insights on the patterns of horizontal and vertical integration, the changing nature of contracts between farmers and different levels of firms, and the relations between domestic and transnational firms, need to be studied at a much larger scale to understand the trends in penetration of transnational capital

2. Technology and digital agriculture as mechanisms of integration: The Bayer Reporting indicates a clear shift to digital services, apart from the core business of chemical inputs. The Bayer Global Reports state the motivation to reduce fertilizer use, probably because the company's management itself realizes that overuse is harmful for its own business. How does this shift manifest itself in mergers and acquisitions with digital providers? What kind of data are collected, and what are the policies on data protection and ownership? These questions need to be answered if a more detailed study is to be done with respect to product penetration and the prevalence and usage patterns of these pesticides in the Karnal area. The connections between expanding corporate markets and digitalisation also needs better understanding.

3. Impact on Forms of Labour and Investment: Further studies are needed to validate the results on economic impact of the rising cost of production in all its aspects. One under studied aspect of this is changing forms of labour and diversification, with respect to: a) its impact on the transforming relationship between large and small farmers and b) forms of labour deployment and use on the other hand. Studies can be particularly extended to include the entire crop rotation system, and c0 changing relationship between on-farm and non-farm livelihood strategies.

4. Aspects of Occupational and Environmental Health: This exploratory study has shed light on some aspects of occupational health and environmental impacts (such as stubble burning and prevalence of pesticide residues). These leads can form the basis of an independent project.

5. Focus on transforming regulatory structures for inputs: The exploratory study has highlighted the growing power of corporations because of deregulation withdrawal of state. Different aspects of the impact of changing regulation on input supplies and penetration of transnationals need to be detailed out. Impact of this on inter-firm relations, particularly between transnational and domestic capital, and their capabilities also need careful assessment. Some focus should be put on the prevalence of transnational corporation's original products vs. counterfeits, the power of branding and proprietary products etc.

6. Improving an understanding of the capabilities of transnational firms: The study has indicated that lead companies possess higher capabilities to invest in new products, integrated R&D, and acquire firms with complementary capacities. This advantage distorts markets and company sources give us some clues into prevailing strategies. In the light of this there is a need to improving literacy of non-financial and financial reporting of big companies and understand their relationships with each other.

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Annexure 1: Bayer Chemicals and Changing Nature of Sources and Competition

S. NO.	PRODUCT NAME (COMPANY)	COMPOSITION	APPROVED SOURCES OF IMPORTERS	INDIGENOUS MANUFACTURERS
1	Nativo (Bayer)	Tebuconazole 50%+ Trifloxystrobin 25% w/w WG (75 WG)	1. Bayer Crop Science LP, 8400, Hawthorn Road, Kansas City, MO 64120, USA 2. *Bayer Crop Science AG, Germany, change to M/s Bayer AG, Germany, (Change of name of source of import), By- Bayer Crop Science Ltd., Mumbai, India for the product Tebuconazole 50%+ Trifloxystrobin 25%WG, in 392nd RC.	
2	Fame (Bayer)	Flubendiamide 480SC (39.35% w/w)	1. Nihon Nohyaku Co. Ltd., Tokyo (Japan), Through Supplier: Sojitz corporation, Minatoku, Tokyo, Japan. 2. Bayer Crop Science AG, Germany. ,(By Ms. Bayer Crop Science Ltd. in 278th RC p) Change to M/s BayerAG, Germany (By M/s in 392nd RC.)	
3	Regent (Bayer)	Fipronil 5 SC (5% w/w)	1. BASF Agri. Production SAS, Elbeuf, France(90%).{Previous Source name was Bayer Crop Science S.A. Lyon, France which was changed in 273 RC (Name of previous source is M/s. Aventis Crop Science S.A. Lyon, France this was changed in 230th RC)} 2. Bayer Crop Science Hangzhou Co. Ltd., No. 5 Road, Hangzhou Economic & technological Development Zone, Hangzhou, 310018,China (90%). 3. Anhui Huaxing Chemical Industry Co. Ltd., Changjing, Mid. Rd. Hefei, Anhui, China 4. Name of the source changed from: Zhejiang Hisun Chemicals Co. Ltd. 97, Waisha Road, Jiaojiang China (By M/s Hilfil Chemicals Pvt. Ltd 95.0 %Min in 367th RC) to M/s Hisun Chemical(Nantong) Co., Ltd., No.20, 4th Haibin Road, Rudong Coastal Economic Development Zone, Nantong city, Jia ngsu Province, P.R. China (by M/s Krishi Rasayan Exports Pvt. Ltd. 95% min. in 416th RC) 5. Bayer SAS, Bayer Environnemental Science, 16 rue Jean-Marie Leclair 69009, Lyon – France 6. * Bayer Crop Science LP, USA, St. Louis through supplier (a) Bayer Crop Science AG, Germany and(b) Bayer Crop Science, LP, USA, St. Louis, 80% WG (By M/s BayerCropScienceLtd in 297th RC) 7. ** Bayer Environmental Science , France (By Bayer Crop Science India Ltd in 348th RC) Change To Bayer SAS, Bayer Environmental Science, France(in332nd RC in case of 0.03%Gel) 8. ***M/s Bayer SAS, Bayer Crop Science Industrial Operations Marle, France. Through Supplier: M/s- Bayer SAS, Bayer Environmental Science,Lyon, France.Fipronil0.05%GEL,FI/9(3). (M/s Bayer CropScience in 408th RC.). 9. *** Kukbo Science Co. Ltd. 49, Sandan- RO, Heungdeok-Gu, Cheongju, Chungbuk, Korea (By M/s Mahamaya Life Science Pvt. Ltd., for grant of registration for Fipronil 0.05% Gel for formulation import in 392nd RC)	10. GhardaChemicalLtd.,Mumbai (TIM) u/s 9 (3) in 240th RC 11. Insecticides India Ltd. 12. Bhagiratha Chemicals & Industries Ltd. 13. Punjab Chemicals and Crop Protection Pvt Ltd 14. PI Industries Ltd 15. CoromandalInternational Ltd., 16. Bharat Rasayan Ltd., New Delhi (92%min.) 17. Hyderabad Chemicals Products Ltd., Hyderabad 18. Pest Control India (Pvt) Ltd, Mumbai (92% min.) 19. Atul Ltd., Valsad 20. Meghmani Organics Ltd., Ahmedabad 21. Tagros Chemicals India Ltd., Chennai (92%) 22. Rallis India Ltd. 23. HPM Chemicals &Fertilizers Ltd., 24. Best Crop Science LLP, Gajraula, UP 25. Sujanil Chemo Industries, Pune 92.0% Min.9(4) 26. Excel Phosphorus(P)Ltd.,92.0% Min.9(4) 27. Sahib Pesticides, Karnal,92.0% Min.9(4) 28. M/s Synergia Science Pvt. Ltd. 92.0%, 9(4) in 342th 29. Anu Products Ltd., New Delhi, 92.0% Min.9(4) 30. Bayer Crop Science Ltd. Mumbai. 31. M/sBonageriCropScience Ltd., 92% min, 9(4), in 386th RC 32. M/s Crimsun Organics Pvt. Ltd., 92.0% Min. 9(4) in 397th RC.

S. NO.	PRODUCT NAME (COMPANY)	COMPOSITION	APPROVED SOURCES OF IMPORTERS	INDIGENOUS MANUFACTURERS
4	Galileo (Du Pont)	Picoxystrobin 22.52%	Dupont de Numorous (France) S.A.S 82,Ruede,Wittelsheim,BP9,F-68701,Cedex, France Through supplier: M/s Du Pont International Operations SarlCheminduPavillon2,CH-1218,LeGrand- Seconnex, Geneva, Switzerland (by E.I Dupont (IndiaPvt. Ltd.In 347th RC)	
5	Chess (Syngenta)	Pymetrozine 50%WG	M/s Syngenta Korea Limited, Iksan Plant, Korea with supplier same as the manufacturer valid up to 28.03.2021(By Syngenta India Ltd. In 347th RC)	
6	Pretilachlor (Generic)	Pretilachlor 50%	1. Syngenta ProdukteAG, Switzerland 2. Hangzhou Qingfeng Agro chemicals Co. Ltd. Formerly known as - (Hangzhou General Pesticide Plant) No 177, Jichang Road, Hangzhou, China through Supplier: Willowood Ltd., unit 2314, Wellborne, Commercial Center 8, Java Road, North Point, Hongkong (By M/s Willowood AgroChem Pvt. Ltd. Bikaner, (Raj.) in 238th RC) 3. M/s Shangdong Binnong Technology Co. Ltd 518,Yongxin Road, Binvei Town, Bigzhou City, Shandong province China through supplier same as source (By M/s Mahamaya Life Sciences Pvt. Ltd , New Delhi in 391/392nd RC) 4. M/s Nantong Weilike Chemical Co. Ltd., Yangkou Road, 4th , Yangkou Industrial Park, Rudong Country, Jiangsu Province, China through supplier M/s- Willowood (Hangzhou) Co. Ltd. Room No.2003, Golden Plaza, No. 118, Quingchun Road, Xiacheng District, Hangzhou City, Zhejiang Province, China (by M/s Willowood Chemicals Pvt Ltd in 414th RC) 5. M/s Shandong Qiaochang Chemical Co. Ltd., South of Xinyongshen Road, Binbei, Bincheng District, Binzhou City, Shandong, China through supplier M/s Shanghai Agrotree Chemical Co. Ltd., Room 712, The Barony Wanyuan Hotel, No. 599, Pudong Avenue, Shanghai, China (by M/s Krishi Rasayan ExportsPvt.Ltd.In 417th RC)	1. Nagarjuna Agrichem Ltd., Hyderabad.u/s 9 (3) in220thRC 2. GSP Crop Science (P) Ltd., Ahmedabad 3. Hyderabad Chemical Product Limited, Hyderabad 4. Siris Crop Science Limited, New Delhi 5. Atul Ltd, Vapi 6. Sudarshan Chemical Industries Ltd, Pune 7. United Phosphorus Ltd 8. Chemtura Chemicals India Pvt Ltd 9. Crystal phosphate Ltd 10. Meghman Industries Ltd 11. Indofil Industries Ltd., Andheri(E), Mumbai 12. Ravi Organics Ltd 13. Deccan Fine Chemicals(India)Ltd., 14. Insecticides India Ltd 15. Punjab Chemicals and Crop Protection Ltd., Mumbai 16. Bharat Rasayan Ltd., Delhi HPM Chemicals & Fertilizers Ltd., N.Delhi 17. Best Crop Science LLP, Gajraula, UP(96%min)9(4) 18. Samardhi Crop Chemicals Ltd. 96.0% min. 9(4).,
7	Fuzimin (Generic)		NA	NA
8	Confidor (Bayer)	Imidacloprid 200 SL (17.8 % w/w)		

S. NO.	PRODUCT NAME (COMPANY)	COMPOSITION	APPROVED SOURCES OF IMPORTERS	INDIGENOUS MANUFACTURERS
9	Regent Ultra (Bayer)	Fipronil 0.6% Gr	1. BASF Agri. Production SAS, Elbeuf, France(90%). {Previous Source name was Bayer Crop Science S.A. Lyon, France which was changed in 273 RC (Name of previous source is M/s. Aventis Crop Science S.A. Lyon, France this was changed in 230th RC)} 2. Bayer Crop Science Hangzhou Co. Ltd., No. 5 Road, Hangzhou Economic & technological Development Zone, Hangzhou, 310018,China (90%). 3. Anhui Huaxing Chemical Industry Co. Ltd., Changjing, Mid. Rd. Hefei, Anhui, China 4. Name of the source changed from: Zhejiang Hisun Chemicals Co. Ltd. 97, Waisha Road, Jiaojiang China (By M/s Hilfil Chemicals Pvt. Ltd 95.0 %Min in 367th RC) to M/s Hisun Chemical(Nantong) Co., Ltd., No.20, 4th Haibin Road, Rudong Coastal Economic Development Zone, Nantong city, Jiangsu Province, P.R. China (by M/s Krishi Rasayan Exports Pvt. Ltd. 95% min . in 416th RC) 5. Bayer SAS, Bayer Environnemental Science, 16 rue Jean-Marie Leclair 69009, Lyon – France 6. * Bayer Crop Science LP, USA, St. Louis through supplier (a) Bayer Crop Science AG, Germany and(b) Bayer Crop Science, LP, USA, St. Louis, 80% WG (By M/s bayer CropScienceLtd in 297th RC) 7. ** Bayer Environmental Science , France (By Bayer Crop Science India Ltd in 348th RC) Change To Bayer SAS, Bayer Environmental Science, France(in 332nd RC in case of 0.03%Gel) 8. ***M/s Bayer SAS, Bayer Crop Science Industrial Operations Marle, France. Through Supplier: M/s-Bayer SAS, Bayer Environmental Science, Lyon, France. Fipronil 0.05% GEL, FI/9(3). (M/s Bayer CropScience in 408th RC.). 9. *** Kukbo Science Co. Ltd. 49, Sandan- RO, Heungdeok-Gu, Cheongju, Chungbuk, Korea (By M/s Mahamaya Life Science Pvt. Ltd., for grant of registration for Fipronil 0.05% Gel for formulation import in 392nd RC)	1. Gharda Chemical Ltd., Mumbai (TIM) u/s 9 (3) in 240thRC 2. Insecticides India Ltd. 3. Bhagiratha Chemicals & Industries Ltd. 4. Punjab Chemicals and Crop Protection Pvt Limited 5. PI Industries Limited 6. Coromandal International Ltd., 7. Bharat Rasayan Ltd., New Delhi (92%min.) 8. Hyderabad Chemicals Products Ltd., Hyderabad 9. Pest Control India (Pvt) Ltd, Mumbai(92%min.) 10. Atul Ltd.,Valsad 11. Meghmani Organics Ltd., Ahmedabad 12. Tagros Chemicals India Ltd., Chennai(92%) 13. Rallis India Ltd. 14. HPM Chemicals & Fertilizers Ltd., 15. Best Crop Science LLP, Gajraula, UP 16. Sujanil Chemo Industries, Pune 92.0% Min.9(4) 17. Excel Phosphorus(P)Ltd.,92.0% Min.9(4) 18. Sahib Pesticides, Karnal,92.0% Min.9(4) 19. M/s Synergia Science Pvt. Ltd. 92.0%, 9(4) in342th 20. Anu Products Ltd., New Delhi, 92.0% Min.9(4) 21. Bayer Crop Science Ltd. Mumbai. 22. M/s Bonageri Crop Science Ltd., 92% min, 9(4), in386thRC 23. M/s Crimsun Organics Pvt. Ltd., 92.0% Min. 9(4) in397thRC.
10	Bavisto (Generic)	Carbendazim 50% WP	1. BASF, West Germany 2. Sinoway International (Jiangsu) Company Ltd., China 3. Jiangyin Rotam Chemical Co.Ltd., Jiangsu, China. 4. M/s Ningxia Wynca Technology Co. Ltd., Taisha Chemical Industry Park, Pingluo, Ningxia, China 5. Change of name of source of Import of Carbendazim Technical 98% w/w min. from M/s Kajo Agrochemical Co. Ltd., No.2, Qingtong Road Qingyang Town, Jiangyin City, Jiangsu China, to M/s Anhui Hauaxing Chemical Industry Co.Ltd., Wujing Town, Hexian County, Anhui, P R China (M/s Coromandel International Ltd. in 409th RC). 6. M/s Anhui Huaxing Chemical Industry Co., Ltd., Wujiang Town, Hexian Country Anhui, China, PC 238251through supplier as M/s Bingo Technology Ltd, Add.:- 5/F Hong Kong trade centre, 161–167 Des Voeux road central, HongKong (by M/s NACI Industries Ltd. in 413th RC)	1. BASF (I)Ltd., Mumbai 2. Alchemic Organics Ltd., Mumbai 3. Artee Graphite Pvt Ltd., Delhi 4. Atul Ltd.,Bulsar 5. Gujarat Insecticides Ltd., Ankleshwar 6. Hindustan Antibiotics Ltd., Pune 7. Hyderabad Chemical Products Ltd., Hyderabad

S. NO.	PRODUCT NAME (COMPANY)	COMPOSITION	APPROVED SOURCES OF IMPORTERS	INDIGENOUS MANUFACTURERS
11	Chloro (Generic)	Chlorpyri-fos-20% EC		
12	Carbendizm (Generic)	Carbendazim	1. BASF, West Germany 2. Sinoway International (Jiangsu) Company Ltd., China 3. Jiangyin Rotam Chemical Co.Ltd., Jiangsu, China. 4. M/s Ningxia Wynca Technology Co. Ltd., Taisha Chemical Industry Park, Pingluo, Ningxia, China 5. Change of name of source of Import of Carbendazim Technical 98% w/w min. from M/s Kajo Agrochemical Co. Ltd., No.2, Qingtong Road Qingyang Town, Jiangyin City, Jiangsu China, to M/s Anhui Hauaxing Chemical Industry Co. Ltd., Wujing Town, Hexian County, Anhui, P R China (M/s Coromandel International Ltd. in 409th RC) 6. M/s Anhui Huaxing Chemical Industry Co., Ltd., Wujiang Town, Hexian Country Anhui, China, PC 238251through supplier as M/s Bingo Tech-nology Ltd, Add.:- 5/F Hong Kong trade centre, 161–167 Des Voeux road central, HongKong (by M/s NACI Industries Ltd. in 413th RC)	1. BASF (I)Ltd., Mumbai 2. Alchemic Organics Ltd., Mumbai 3. Artee Graphite Pvt Ltd., Delhi 4. AtulLtd.,Bulsar 5. Gujarat Insecticides Ltd., Ankleshwar 6. Hindustan Antibiotics Ltd., Pune 7. Hyderabad Chemical Products Ltd., Hyderabad 8. New Chemie Industries Ltd., Mumbai 9. PaushakLtd.,Baroda. 10. RotamIndiaLtd. 11. Megmani Industries Ltd. 12. Gharda Chemicals Ltd 13. Sudarshan Chemical Industries Ltd., Pune 14. Bayer Crop Science Ltd., Mumbai.
13	Butacholor (Generic)	Butachlor 50%	1. Monsanto Agricultural Products Co., USA Through Supplier M/s Sinochem International (Overseas) Pte. Ltd., 9 Raffles Place, 50-01 Republic Plaza, Singapore – 048619 2. Shen Hong Chemical Corporation, Taiwan 3. Shinung Corporation Taichung, Taiwan. Source change to M/s. SINON Corporation Taichung, Taiwan 4. M/s Nantong Jiangshan Agro Chemical & Chem-icals Limited Liability Co., Add-998, Jiangshan Road, Nantong Economic & Technological Development Zone, Nantong, Jiangsu China through supplier M/s Sinochem International Corporation Add- 19/F, Jinmao Tower, No. 88, Century Boulevard, Pudong New Area, Shanghai200121, P. R. China (by M/s Sinochem India Company Pvt. Ltd. 95% min. In 413th RC)	1. Hindustan Insecticides Ltd., Delhi. 2. Montari Industries Ltd., Delhi. 3. Siris India Ltd., Hyderabad. 4. Insecticides India Ltd. 5. JaishreeAgro Industries Ltd, Delhi 6. Hyderabad Chemical Products Ltd. 7. Coromandel International Ltd., Secunder-abad 8. Bharat Rasayan Ltd., Delhi 9. Sudarshan Chemical Industries Ltd., Pune
14	Tricoderma (Generic)	Tricoderma 2% WP	N/A	N/A
15	*Corogen (Generic)*	*Rynaxypyr® active – Chlor-antraniliprole 18.5% w/w SC*	*1. M/s. DuPont Asturias S.L. Valle de Tamon Nubledo 33469 Taman-Carreno Asturias, Spain through Supplier M/s. Dupont International Operations Sarl Chemin du Pavillon, Geneva, Switzerland. (By M/s E.I. Dupont India Pvt. Ltd in 292nd RC)* *2. E.I. DuPont de Nemours & Co. DuPont Crop protection, Mobile Manufacturing Center, 12650 Highway 43, P O Box 565, Axis, Alabama, USA, Source name Change to M/s FMC Corporation, Mobile ManufacturingCentre,12650, Highway 43, P.O. Box 565, Axis Alabama 36505-0565, USA (Endorsement by M/s Syngenta India Ltd. in 404th RC). through supplier: M/s DuPont Inter-national Operations Sarl, 2 Chemin du Pavillon, 1218 Le grand Saconnex, Geneva, Switzerland.* *3. Dupont Agricultural Chemicals Through Supplier :M/s Dupont Company(Singapore) Pte. Ltd., 1 Harbour Front Place# 11-01, Harbour Front Tower One, Singapore 098633*	

Annexure 2: Changing Pattern of Land Holdings in Districts of Karnal Zone

KURUKSHETRA

Proportion of Operational Land Holdings By Size Class of Land						Proportion of Operational Area Controlled By Size Class of Land					
	1985–1986	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**		**1985–1986**	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**
Marginal	35	41.6	42.3	46.19	50.1	**Marginal**	6.2	8.06	8.3	7.37	10.32
Small	20.1	19.74	21.4	19.41	19.9	**Small**	11.15	12.61	13.4	10.22	13.31
Semi-Medium	21.1	20.99	20.1	17.43	16.1	**Semi-Medium**	22.1	24.45	24.4	18.61	21.12
Medium	19.03	14.21	13.4	12.68	10.86	**Medium**	38.4	36.16	34.8	29.1	30.37
Large	4.64	3.47	2.69	4.28	3.09	**Large**	21.9	18.7	18.8	35.5	24.96

KARNAL

Proportion of Operational Land Holdings By Size Class of Land						Proportion of Operational Area Controlled By Size Class of Land					
	1985–1986	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**		**1985–1986**	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**
Marginal	40.2	43.79	51.5	46.7	46.4	**Marginal**	7.6	7.88	9.25	7.9	7.93
Small	19.9	18.47	18.8	19.37	20.6	**Small**	12.18	11.01	13.1	11.42	11.7
Semi-Medium	21.3	22.66	15.9	17.88	18.67	**Semi-Medium**	25.35	24.35	21.2	20.55	20.7
Medium	15.7	14.37	10.72	12.48	12.94	**Medium**	37.5	35.17	30.28	30.56	30.98
Large	2.66	2.74	2.91	3.54	3.59	**Large**	17.2	21.62	25.82	29.56	28.61

PANIPAT

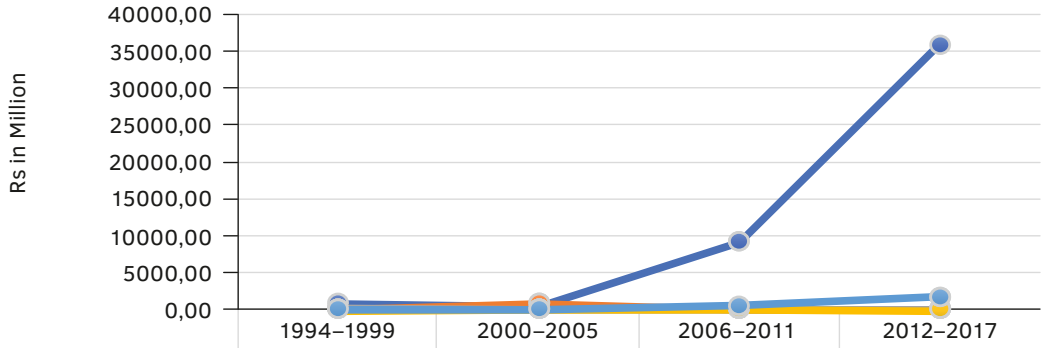
Proportion of Operational Land Holdings By Size Class of Land						Proportion of Operational Area Controlled By Size Class of Land					
	1985–1986	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**		**1985–1986**	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**
Marginal		48.4	61.87	62.2	60.5	**Marginal**		11.72	16.65	17.96	17.21
Small		20.67	17.2	16.5	17.5	**Small**		16.42	16.4	16.34	14.87
Semi-Medium		20.56	12.6	13.24	13.17	**Semi-Medium**		31.12	23.6	25.17	37.8
Medium		9.11	6.95	6.98	7.32	**Medium**		28.48	27.6	26.95	15.2
Large		12.58	1.2	1.08	1.35	**Large**		12.27	15.7	13.84	20.13

HARYANA

Proportion of Operational Land Holdings By Size Class of Land						Proportion of Operational Area Controlled By Size Class of Land					
	1985–1986	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**		**1985–1986**	**1990–1991**	**2000–2001**	**2010–2011**	**2015–2016**
Marginal	37.2	40.66	46.08	48.11	49.28	**Marginal**	6.1	7.95	8.9	9.89	10.85
Small	19.64	19.85	19.25	19.47	19.28	**Small**	10.3	12.47	11.88	12.69	12.73
Semi-Medium	20.8	21.99	18.19	17.55	17.07	**Semi-Medium**	21.2	25.43	21.99	22.34	22.22
Medium	17.74	14.5	13.2	12.04	11.81	**Medium**	37.9	35.04	34.08	32.52	32.36
Large	4.46	3	3.25	2.83	2.54	**Large**	24.28	19.11	23.11	22.56	21.83

Annexure 3: Combined Forex Earnings and Spendings by Indian Subsidiaries Dealing in Seeds and Agro Chemicals

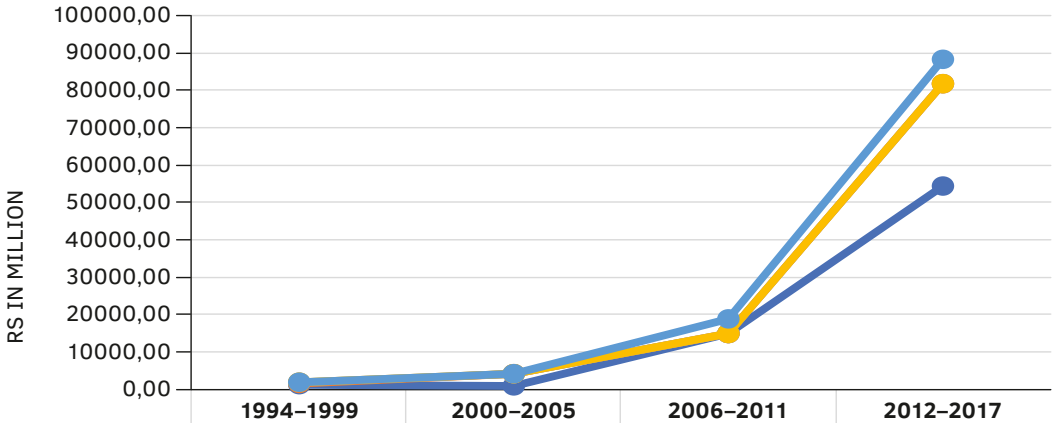
Figure 1.3.1: Total Forex Earnings of Indian Subsidiaries



	1994–1999	2000–2005	2006–2011	2012–2017
Bayer	811,20	460,40	9150,90	35779,30
Dow	72,60	870,80	0,00	0,00
Dupont	142,30	0,00	0,00	0,00
Mahyco	0,00	66,30	5,30	0,00
Monsanto	0,00	0,00	501,20	1743,00

(CMIE PROWESS data for different years)

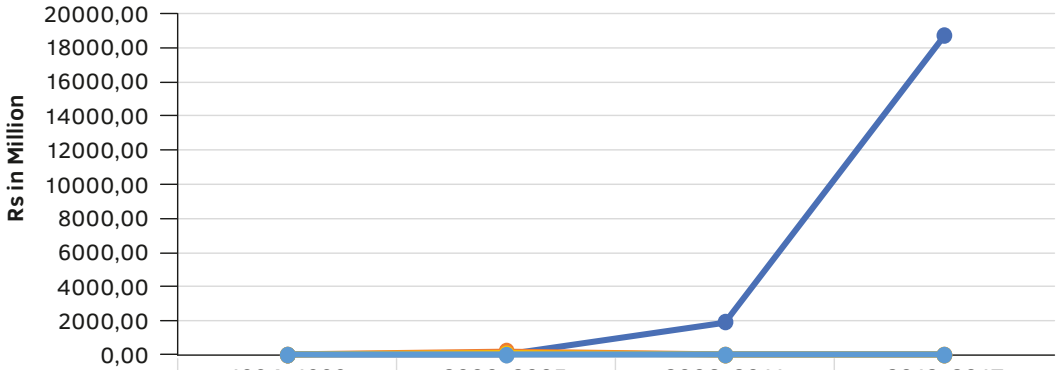
Figure 1.3.2: Total Forex Spendings of Indian Subsidiaries



	1994–1999	2000–2005	2006–2011	2012–2017
Monsanto	0,00	49,00	3720,90	6446,30
Mahyco	0,00	120,00	26,60	0,00
Dupont	323,30	0,00	0,00	0,00
Dow	486,90	3050,80	0,00	27587,20
Bayer	1158,60	930,40	14971,50	54216,80

(CMIE PROWESS data for different years)

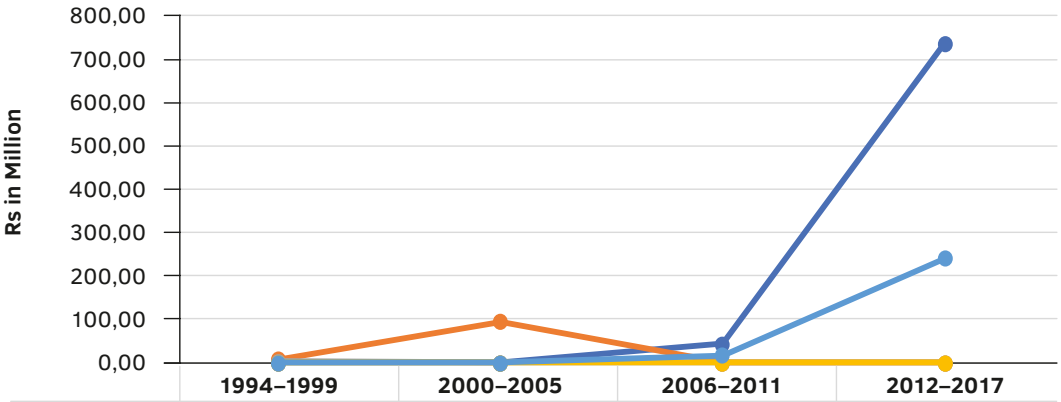
Figure 1.3.3: Import of Finished Goods by Indian Subsidaries



	1994–1999	2000–2005	2006–2011	2012–2017
Bayer	18,10	78,00	1905,00	18747,00
Dow	0,00	211,70	0,00	0,00
Dupont	0,00	0,00	0,00	0,00
Mahyco	0,00	97,60	26,60	0,00
Monsanto	0,00	0,00	0,00	0,00

(CMIE PROWESS data for different years)

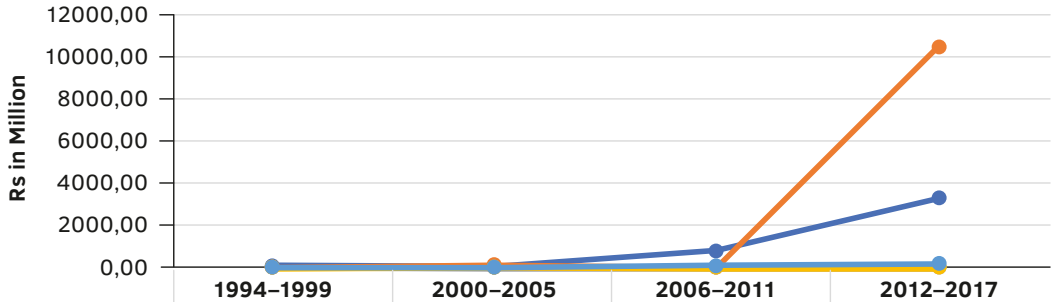
Figure 1.3.4: Forex spending on Royalty/ Technical Knowhow of Indian Subsidiaries



	1994–1999	2000–2005	2006–2011	2012–2017
Bayer	0,00	0,00	43,00	737,20
Dow	7,20	94,80	0,00	0,00
Dupont	3,10	0,00	0,00	0,00
Mahyco	0,00	0,00	0,00	0,00
Monsanto	0,00	0,00	16,40	241,30

(CMIE PROWESS data for different years)

Figure 1.3.5 Forex spendings others of Indian Subsidaries



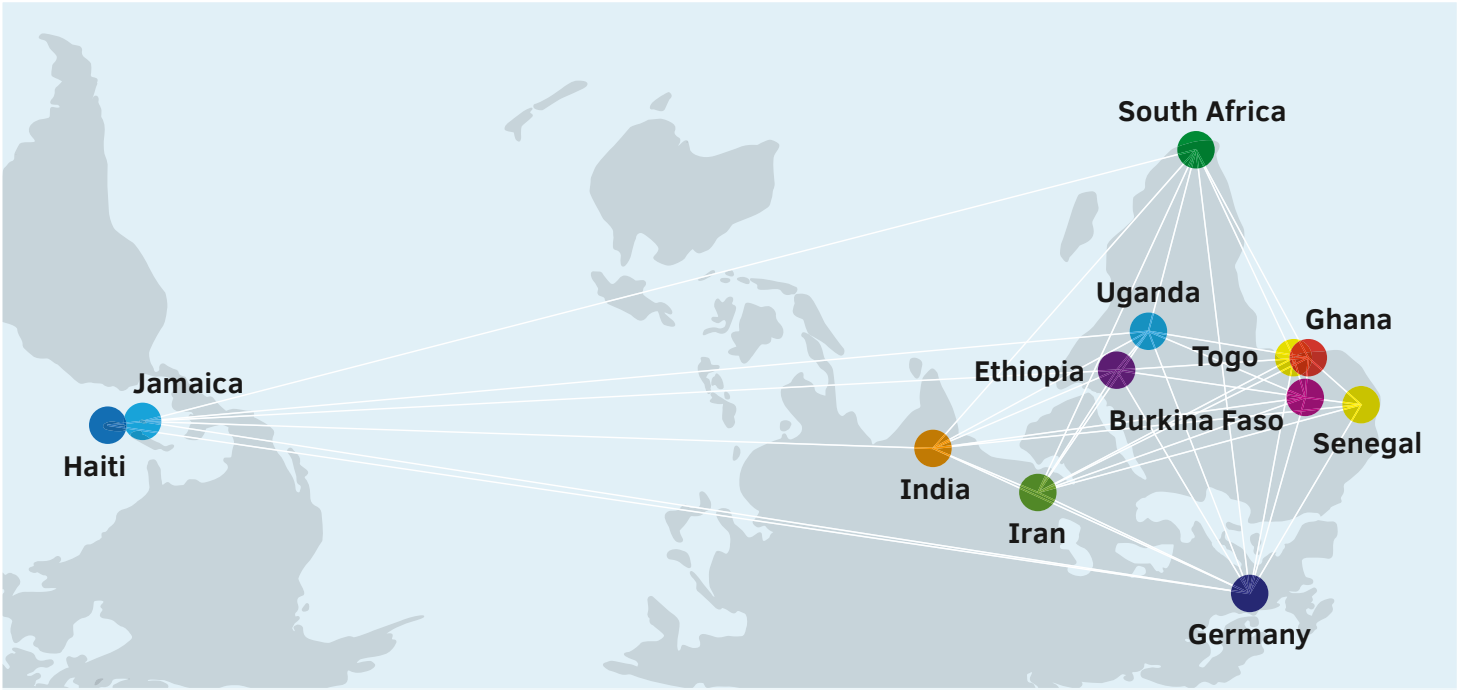
	1994–1999	2000–2005	2006–2011	2012–2017
Bayer	103,40	26,90	807,70	3306,90
Dow	1,20	123,20	0,00	10495,70
Dupont	11,40	0,00	0,00	0,00
Mahyco	0,00	10,50	0,00	0,00
Monsanto	0,00	1,40	105,00	173,20

(CMIE PROWESS data for different years)

Global Partnership Network

University of Kassel
Kleine Rosenstraße 1-3, D-34109 Kassel
gpn@uni-kassel.de

www.uni-kassel.de/go/GPN



The Global Partnership Network

This world map displays all countries in which GPN partner institutions are located. The South-Up projection draws attention to overcome Eurocentrism and to take a multitude of perspectives and knowledges into account.

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Federal Ministry for Economic Cooperation and Development

DAAD Deutscher Akademischer Austauschdienst German Academic Exchange Service

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