Seeds of Change: Intellectual Property Rights, Genetically Modified Soybeans and Seed Saving in the United States

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Abstract

Seed saving is a historical cultural phenomenon that dates back to the beginning of agriculture itself. Seeds, because of their unique characteristics – the seed contains within itself the means for its own reproduction – have offered a particularly large stumbling block to capital accumulation. In the US, intellectual property rights legislation and Supreme Court decisions have played a profound role in overcoming these unique characteristics and have made it possible for input supply companies to extract more profit from the farm production process. Our analysis of the historical seed-saving practices of soybean farmers in the US indicates that large farms have consistently saved seed in the US – as much as 60 per cent in some years. However, with the introduction of Roundup Ready® soybeans the nature of seed saving was drastically changed. We argue that the combination of expanding intellectual property rights, ‘new’ GM technology, and the ideology of the technological treadmill have successfully overcome seeds’ inherent obstacles to capitalist accumulation. In capitalising nature’s production, Monsanto and other leading seed corporations have been able to incur massive profits from the licensing of commercial seed supplies. As a result, US farmers are facing further loss of control of the farm production process.

Introduction

The commodification of seeds as private property to be bought and sold for profit is a relatively recent phenomenon of global agricultural practice (Busch et al. 1995). In contrast, as long as agriculture has existed, farmers have assumed the universal right to save, replant, and exchange seed from their harvests. Replanting saved seed has allowed farmers to maintain local control over their farming practices. Furthermore, seeds, because of their unique characteristics – the seed contains within itself the means for its own reproduction – have offered a particularly large stumbling block to capital accumulation (Kloppenburg 1988) in advanced capitalists countries. It is this unique characteristic that Marxist scholars (such as Karl Kautsky (1899 [1989]), Jack
Klopperburg (1988), David Goodman and colleagues (1987, 1991), and Susan Mann and James Dickinson (1978)) have posed as the main reason for the maintenance and persistence of the family farm in advanced capitalist countries.

However, as Vandana Shiva (1997, 2000) and others point out, this age-old tradition is much more than simply saving seed. It requires considerable skill, as the seed must be selected based on the performance of the parent plants and knowledge regarding local biogeoclimatic conditions. Furthermore, the practice of saving seed is equally demanding. It requires storage facilities, cleaning and treatment equipment and labour-intensive practices. The seed must be prepared such that it is free of insects and diseases that might reduce or contaminate future yields. Additionally, seeds must be stored at the right temperature and moisture conditions to ensure proper germination in the following season.

Much of the research on seed saving has been directed at the impact on the economies, cultures, and farming practices of the South (Pearce 1980; Lipton and Longhurst 1985; Kloppenburg 1988; Buttel and Larson 1990; Shiva 1993, 1997, 2000). This focus on the South may in part be attributed to a concern for the restructuring of agriculture and food in the South as a consequence of globalisation (Goodman et al. 1987; Goodman and Redclift 1991; McMichael 1991, 1994). In such research, the globalisation of agrifood systems is usually considered a cause of the destruction of the diversity of local food cultures and local food economies and of biodiversity loss and environmental degradation.

Using data from the United States Department of Agriculture (USDA) and various other private and public sources, this article analyses the seed-saving practices of US soybean farms. Our analysis suggests that a large majority of US soybean farms have, until recently, engaged in the traditional practice of seed saving, usually associated with labour-intensive farming practices of the South. We argue that this traditional practice, which provides farmers with control over their enterprise, economic revenue and food security, is much more than simply saving seeds. Furthermore, we argue below that the expansion of intellectual property rights combined with the introduction of genetically modified (GM) varieties under the conditions of the technological treadmill have recently drastically transformed this traditional practice. Lastly, this article elucidates the implications of these findings for agrifood networks, particularly in terms of structural inequalities and knowledge practices, and suggests consequences for seed saving in the US.

The practice of saving seed

For those farmers with the requisite know-how, saving seed is an effective method for minimising their dependence on commercial suppliers. Not having to purchase seed every year is both a matter of saving money and of remaining to some degree independent of seed companies’ breeding programmes. Furthermore, Land Grant universities, usually working in conjunction with the farming community, routinely release new seed varieties to certified seed growers, who in turn grow and then sell the certified seed to other seed producers (Boland et al. 2001). After planting a certified seed variety for the first time, farmers often keep some seed from the harvest for use in the following year.
The ability to save one’s own seed offers strong competition to the seed industry. For example, the competition from wheat farmers in Kansas forced Pioneer Hi-Bred to give away its hard wheat programme to Kansas State University (personal communication 2003). Given their capacity to self-reproduce, the saved seed has reduced the prices that seed companies can charge to farmers. Indeed, Kloppenburg (1988) posited that seed companies were rarely profitable before the advent of intellectual property protections on seed. For example, the average estimated cost of Kansas certified wheat seed from 1992 to 1999 was $7.85 per bushel, whereas the estimated farmer-saved wheat seed cost during the same period was $4.34 (Boland et al. 2001). Therefore, farmer-saved seed not only served to keep seed prices from rising excessively; it also allowed farmers to avoid annual seed purchases if they so desired. Furthermore, the funds required to purchase seed are typically needed at the same time that farmers are likely to have a negative cash flow. And while the price of seed is a small percentage of the overall cost of production when compared with the cost of equipment, fuel, fertilisers, lime, herbicides and insecticides, certified seed is consistently more expensive than farmer-saved seed. As such, farmers who saved seed could generally reduce principal and interest that would otherwise be paid on farm loans. At the same time farmers can retain a certain degree of independence from seed companies, which may or may not have seeds that specifically match the farmers’ biogeoclimatic requirements.

This is as true for seed planted at the beginning of the growing season as for particular replanting demands following torrential rain, freezing conditions and frost, or other environmental destruction of seed and plants already in the ground. Having a ‘reserve army’ of seeds provides farmers with the option to replant immediately after these adverse weather conditions. Seed saving, then, provides a valuable, convenient and affordable insurance against most disruptions of the input supply chain. This is of particular relevance in the US today where less than 2 per cent of the population are engaged in farming and only a fraction of them save seed.

In sum, seed saving is a long-standing global institution, probably as old as agriculture itself. It helps farmers control their enterprises and maintain their independence; it allows them to predict how well a crop will perform in the following season; it allows them to participate in maintaining the crop; it serves as insurance against inadequate supplies of seed; it helps to maintain food security and it creates a viable market that ensures that seed prices remain affordable.

Theorising the obstacles to the development of capitalist agriculture

In his careful and critical analysis of the consequences of the Western European farm crisis of the twentieth century, Russian Marxist Karl Kautsky (1899 [1989]) noted that agriculture has been particularly resistant or slow to adapt to the rapid industrial development of the global agrifood system. In particular, Kautsky observed that because of nature’s peculiarities and the ability of family farms to persist through self-exploitation, agriculture has presented a particular stumbling block to capitalist accumulation strategies.

Writing on one of nature’s peculiarities – the seed – Kloppenburg (1988) provided perhaps the most in-depth analysis of the historical, structural and institutional
dynamics of the contemporary struggle over control of plant genetic resources. The contested terrain of seeds, according to Kloppenburg, has each side of the germplasm controversy defining the other side’s possessions as a common heritage. Internationally, Northern capitalist nations and multi-national seed companies have attempted to retain free access to the developing world’s storehouse of genetic diversity, while the South has attempted to have the propriety varieties of the North’s seed industry declared a public good. Similarly, in the US farmers have struggled to retain ownership over seeds and the informal seed-saving market, while seed companies have tried to appropriate them.

One theme that is prevalent in Kloppenburg’s research is that seeds, because of their unique characteristics have offered a particularly large stumbling block to capital accumulation (Kloppenburg 1988). This theme was also the focus of Mann and Dickinson’s (1978) influential analysis of the obstacles to the development of a capitalist agriculture. Concerned with the persistence of rural petty commodity production (household farms) in the US and whether their persistence undermined Marx’s theory of capitalist development, they posited that ‘it is the peculiar nature of certain spheres of agricultural production which make them unattractive to capitalist penetration.’ For Mann and Dickinson, it was the seed’s peculiar nature that made it unattractive to capitalist agriculture.

Starting with Marx’s theory of labour and production time, Mann and Dickinson argued that in the production of certain agricultural commodities there is a disjuncture between production and labour time that inhibits capitalist penetration. This disjuncture, they argued, is the result of ‘natural’ and ‘objective’ constraints. The effect of these constraints is an ‘excess of production time over labor time’ (labour time being responsible for the creation of exchange value) that causes the ‘inefficient use of constant capital, labor recruitment problems, a lower rate of profit and complications in the smooth realisation of value in the sphere of regulation’ (1978, p. 479).

Mann and Dickinson acknowledged that capital has been able to penetrate agriculture in other ways (for example, in the control of inputs and outputs), but because capitalism had yet (at the time of their writing) to overcome the labor-production disjuncture, it was not yet profitable for capital to control specific spheres of agriculture, such as the reproduction of seeds. For Mann and Dickinson (1978) the relative difficulty of modifying or overcoming the labor-production disjunction accounts in part for the persistence of peculiar forms of production in agriculture. Until recently, seed saving represented one such peculiar form of resistance.

Accordingly, Friedmann (1978) and others have concluded that these peculiar characteristics of seeds in particular, and agricultural production more generally, often lead to the persistence of simple commodity production in capitalism. For example, Pfeffer’s (1983) analysis of fruit and vegetable production illustrated how the growth of a cheap, migrant wage labour force enabled capitalism to penetrate into that sphere of agricultural production.

In an attempt to offer an alternative perspective on this debate, Goodman et al. (1987) asked how capitalism has continued to make inroads into agriculture notwithstanding the biological and social forms of resistance to it. They answered by developing the concepts of appropriationism (the appropriation of on-farm processes, transforming them into industrial activities, e.g., cheese production) and
substitutionism (the development of substitutes for farm products, e.g., margarine). In line with this reasoning, the development of hybrid seed varieties creating a 'natural' form of intellectual property, represented a breakthrough in industrial capital's control over the biological production of seeds. Furthermore, this form of appropriation led to a major reorientation of the entire corn commodity chain (Berlan and Lewontin 1986; Fitzgerald 1990).

But before exploring the relationship between the expansion of intellectual property rights and seed saving in the US, it is worth mentioning that while these debates are somewhat dated, they do underscore the complexity of theorising the development of a global capitalist agriculture. Furthermore, this literature has been substantially updated by more recent work (Bonanno et al. 1994; Busch et al. 1995; Goodman and Watts 1997). For example, Bonanno and colleagues (1994) argue that the central defining element behind the new capital accumulation spaces in agriculture is the transnational corporation – a subject we expand upon further in this article. And as Fred Buttel (1996, p. 33) cogently summarises the issue, these debates, both historical and contemporary, continually introduce and re-introduce important issues 'concerning the prospects of, and limits to, technologically-driven homogenisation of agriculture'.

Data analysis

From 1956 until 1975, the USDA’s Agricultural Marketing Service, Crop Reporting Board provided an annual statistical reporting service that included empirical data for the production, farm use, sales and value of field and seed crops. With the cessation of the Crop Reporting Board’s service in 1975, more contemporary data has been very difficult to obtain. However, we were able to locate more contemporary data, to augment the historical database, from USDA’s Economic Research Service’s Statistical Bulletins and Doane Agricultural Services (1991, 1996–2002). We have been particularly interested in tabulating historical trend data regarding the number of farms planting soybeans and the acres planted each year per state; the percentage of farms planting bin run (saved) seed and the acres of bin-run seed planted each year per state; and the percentage of saved seed by farm size category.

We suggest that the data illustrates two historical trends with respect to soybean seed-saving practices in the US prior to the introduction of GM soybean in 1996. Firstly, farmers have historically been engaged in seed-saving practices. More importantly perhaps is that significant proportions, sometimes as much as 70 per cent, of soybean varieties have been grown from homegrown seed. The second trend suggests that it was the larger capital intensive farming operations, not the small family farm, that typically saved seed. Below we argue that in the US intellectual property rights have had a profound role in terminating these trends and re-structuring this industry.

Seed saving in the US and the expansion of intellectual property rights

In the US, intellectual property rights (IPR) have had a profound role in transforming seeds and restructuring the industry. Firstly, as noted above, the development of
hybrid seeds, especially for corn, gave its developers what was tantamount to a patent on the seed (Berlan and Lewontin 1986; Fitzgerald 1990). However, only certain crops were easily hybridised. Then, the Plant Variety Protection Act (PVPA) of 1970 (7 USC § 2321 et seq.) made it possible for seed companies to receive a 17-year protection on new varieties of sexually produced seeds, other than hybrids, that they had developed. Under this Act companies were awarded Plant Variety Protection Certificates for new varieties shown to be distinct, uniform and stable. However, farmers were still allowed to save seed for replanting and to sell part of their seed to other farmers. As such, under PVPA, strict control of the new varieties by the owner of the certificate was virtually impossible (Fuglie et al. 1996). In 1994 PVPA was amended to increase incentives for private plant breeders. As a result, farmers were no longer permitted to sell seed without a license from the owner of the variety and seed saving was only allowed for personal replanting. Attracted by the prospect of patent-like protection for new seed varieties, large chemical, oil and processing corporations acquired many of the independent seed companies and began to fund substantial research and development efforts.

Later, judicial action significantly extended intellectual property claims by permitting utility patents for plant material. In 1980, the US Supreme court ruled in Diamond v. Chakrabarty (447 US 303) that human-made living material – in that case genetically engineered microorganisms – was patentable. Then, in 1985, in Ex parte Hibberd (227 USPQ (BNA) 443), the Patent and Trademark Office’s Board of Appeals and Interferences concluded that patents could be issued for all seeds, plants, plant parts, plant genes and tissue cultures.

A second wave of mergers occurred congruent with, or in anticipation of, the extension of patents to seeds, plants and tissue cultures. This phase was exemplified by the acquisition of major seed companies by agricultural chemical firms such as Dow, Dupont and Monsanto. This restructuring reduced the number of independent seed companies, while simultaneously substantially increasing capital investment for plant breeding and biotechnology research. Indeed, private investment in agricultural research tripled in real terms between 1960 and 1992 (Fuglie et al. 1996).

By 1994 the total estimated expenditure for plant breeding in the US was $551 million, of which 61 per cent or $338 million was from the private sector (Frey 1996). While more recent data are unavailable, given the rate of acquisitions and mergers in the 1980s and 1990s, it is likely that private sector investment increased beyond previous estimates. Furthermore, Frey (1996) posits that the public sector no longer has adequate financing and human resources to educate and train plant breeders, essentially transferring traditional knowledge and training to the private sector.

After more than three decades of intensive mergers and acquisitions, the structure of the seed industry is settling into three distinct tiers (Table 1). According to the ETC Group (2005) the top 10 seed companies now account for an estimated market value of $21 billion for commercial seed sales worldwide. These 10 multinational corporations control about half of the global seed market (ETC Group 2005). The top tier is dominated by three ‘life science’ industry titans: Monsanto, Dupont and Syngenta. In 2004, Monsanto’s biotech seeds and/or trait technology accounted for 88 per cent of the total GM crop area worldwide. Then in January of 2005 Monsanto acquired Seminis for $1.4 billion catapulting it into the position of leading biotech giant and...
dethroning the perennial kingpin, Dupont’s Pioneer Hi-Bred International (ETC Group 2005).

The second tier includes large, multinational seed companies, many of which have parallel interests in agrochemicals and/or pharmaceuticals. By the time this article is published many of companies in the second tier will have been acquired by the larger agrochemical and/or pharmaceutical giants. New alliances, mergers and acquisitions involving both first- and second-tier companies are likely to continue. The third tier is comprised of small and medium-sized independent seed companies. This tier is rapidly declining and may soon cease to exist as distinct from the agrochemical and/or pharmaceutical giants located in tiers one and two.

The extension of intellectual property rights was intended to encourage investment in research and development in the agricultural sector. As shown above, it has certainly done that. However, in addition to encouraging research and development, it has also contributed to the rapid monopolisation of the seed sector and the subsequent collapse of traditional seed markets.

However, little information exists with regard to the consequences of utility patents for crops on seed-saving practices in the US. Even less information is available on the social and economic costs associated with such patenting. However, using various sources we have been able to document some fairly telling trends regarding soybean seed-saving practices, costs to farmers and the effect of the extension of intellectual property rights.

GM soybeans, seed saving and the restructuring of the agrifood sector

Soybeans are an important cash crop in the US, ranking second to corn in production value. Furthermore, farmers growing soybeans have historically saved a large percentage of their seed for replanting (Figure 1). Savings rates have ranged from a peak of 63 per cent in 1960 to 33 per cent in 1991. Furthermore, from 1955 to 1974 the average bin run (i.e., saved) seed planted per year over this 20-year period was 51 per cent. In

<table>
<thead>
<tr>
<th>Company</th>
<th>2004 seed sales US$ million</th>
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<tbody>
<tr>
<td>1. Monsanto (US) + Seminis (acquired by Monsanto 3/05)</td>
<td>$2,277 + 526 = $2,803</td>
</tr>
<tr>
<td>2. Dupont/Pioneer (US)</td>
<td>$2,600</td>
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<td>3. Syngenta (Switzerland)</td>
<td>$1,239</td>
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<td>4. Groupe Limagrain (France)</td>
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<td>5. KWS AG (Germany)</td>
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<td>6. Land o’ Lakes (US)</td>
<td>$538</td>
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<td>7. Sakata (Japan)</td>
<td>$416</td>
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<td>8. Bayer Crop Science (Germany)</td>
<td>$387</td>
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<td>9. Taikii (Japan)</td>
<td>$366</td>
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<tr>
<td>10. DLF-Trifolium (Denmark)</td>
<td>$320</td>
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<td>11. Delta &amp; Pine Land (US)</td>
<td>$315</td>
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Source: ETC Group 2005
other words historically, just over half of all the soybean seed planted in the US was bin-run seed. Moreover, it was generally the larger farmers who saved seeds. Typically, owners of these larger operations had more capacity, were likely to be more educated and able to save seed properly and had more to gain financially by successfully saving seed for planting in the following season.

Figure 1 illustrates the percentage of seed saved by US soybean farmers from 1955 to 2001. The decline in saved soybean seed from 1955 to 1974 – before GM soybean – was approximately 1.4 per cent per year. However, with the introduction in 1996 of Monsanto’s Roundup Ready® soybean, a genetically modified herbicide tolerant variety, the rate of decline in soybean seed saving increased to 2.3 per cent per year from 1996 to 2002, essentially doubling in just six years.

More remarkable perhaps has been the intensive adoption of Monsanto’s Roundup Ready® soybean since its introduction – in spite of the lack of any significant yield increase. For example, Monsanto accounted for 91 per cent of the worldwide GM soybean area in 2004 (ETC Group 2005). However, Ervin et al. (2000) suggest that when examined worldwide, all currently available transgenic crops account for a yield increase of no more than 2 per cent. In fact, in some instances farmers actually experienced a yield decrease. For example in 2001, 72.4 million acres of soybeans were harvested in the US with a production value of $12.5 billion. However, of that amount only 10 per cent originated from farmer-saved seed. Furthermore, government data sources reveal that in some areas seed saving has all but

ceased (United States Department of Agriculture 2002b). In order to explain the apparent contradiction we need to invoke Willard Cochrane’s theory of the technological treadmill (1993; 2000).

In fact the rapid adoption of Roundup Ready® soybeans is a classic example of the technology treadmill in action as insightfully outlined by Willard Cochrane (1993, 1996, 2000). As the theory suggests, given the inability of farmers to affect the prices they receive for their commodity crops, farmers can only increase their profits by adopting new technologies that decrease their costs. However, only early adopters of new technology gain because the ‘efficiencies’ – usually in terms of increased profits – gained from widespread adoption itself pushes the prices received by all farmers downwards, thus abolishing any comparative advantage. When confronted with the rapidly expanding technologies of nature’s production farmers are left with few options: loyalty to the technology treadmill or exiting the industry all together, the latter being an option few are willing to consider (Hirschman 1970).

The major draw of Roundup Ready® soybeans was that they required less farmer labour and management time. This point is considerable, particularly when one recalls that the persistence of family farms has been through their ability to self-exploit farm labour (Kautsky 1899 [1989]). Furthermore, GM soybeans are relatively simple to use, and increased flexibility in herbicide application – provided that one used a glyphosate herbicide such as Roundup® – allows spraying to occur throughout most of the crop cycle. This flexibility also fits well with conservation tillage and other production inputs currently in practice (United States Department of Agriculture 2002a). However, while these benefits have an economic value in terms of reduced labour and management, little empirical data is available to substantiate such claims. Furthermore, this value is difficult to measure. For example, Boland et al. (2001) have argued that some farmers, particularly those with limited opportunities, place a low value on their time. Conversely, other farmers may place a higher value on their time, particularly if they have other opportunities or labour needs.

This decline in seed saving has shifted a significant portion of the value of bin-run seed from farmers to commercial seed retailers and their parent owners. The value of bin-run seed in 2000 was $169.9 million or approximately half its value before the introduction of Roundup Ready® soybeans. This decline in bin-run seed amounted to approximately $374 million in additional profits in 2001 to commercial seed retailers. However, the rapid decline of seed saving by farmers and its economic impact is only one consequence of the expansion of intellectual property rights and the subsequent restructuring of the agrifood sector. For as rapidly as seed saving has been declining, the cost of seed has been rising. For example, in 1975 a bushel of soybean seed cost $7.34. Twenty years later, in 1994, it was $12.21. However, in 1997, one year after the introduction of Roundup Ready® soybeans, the price of soybean seed jumped to $17.40 and six years later, in 2003, sold for $24.20 per bushel (Figure 2). This is not to say that farmers who adopted Roundup Ready® seed necessarily lost money; in addition to saving time and labour, Roundup Ready® technology reduced the need for the conventional herbicides otherwise used with non-GM farming practices. However, that said, Monsanto’s monopoly on the germplasm used in Roundup Ready® seed and near monopoly on glyphosate gave them considerable discretion.
with respect to licensing and pricing. Moreover, it is highly unlikely that farmers could abandon the new seed-herbicide system now without suffering significant losses.

Another consequence of the release of GM soybeans has been the ability of Monsanto and other chemical companies to enroll other seed companies in the soybean seed chain. Part of this enrollment was the consequence of three decades of intensive mergers and acquisitions, where small commercial breeders were simply assimilated by the agrochemical giants. Furthermore, Monsanto’s ‘no-replant’ licensing clause, which prohibited seed saving, combined with the fact that (for several years) farmers could only use Roundup® brand herbicide on the seed they purchased, meant that the commercial retailers could substantially increase their revenues. Before purchasing GM soybeans, farmers must acknowledge that they have received a Limited Use License (Monsanto Company 2002). Furthermore the Agreement states that the farmer must

neither ... use Monsanto patent protected Seed nor ... provide it to anyone else to use for crop breeding, research, generation of herbicide registration data or seed production. [And] to use in Roundup Ready® crops only a Roundup™ brand or other authorised non-selective herbicide which could not be used in the absence of the Roundup Ready® gene.

Monsanto’s attempt to tie its Roundup® brand of herbicide to the purchase of its Roundup Ready® seed, combined with the fact that farmers could no longer save seed if they entered into this agreement, meant that farm supply dealers could essentially double their market and revenues, a very significant gain considering the stagnant revenues historically associated with commercial seed sales. As such, GM soybeans presented a much more commercially attractive vehicle than non-GM
soybeans for seed dealers and their enrolment was rapid. Furthermore, in 2001, sales from Roundup® herbicide soared to over $2.4 billion, making it the best-selling chemical in modern industrial agriculture (Barboza 2003).

The introduction of GM soybeans has also changed who saves seed in the US. A survey of Indiana soybean farmers in 1986—10 years prior to the introduction of GM soybean—revealed that, of the farmers surveyed, 92 per cent saved some soybean seed from their own production for planting the following year (Harms 1986). Moreover, a USDA report in 1990 revealed a positive correlation between the percentage of homegrown seed planted and farm size, i.e., larger farms planted a higher percentage of homegrown seed (Figure 3). These historical observations are in stark contrast with current seed-saving practices. Moreover, while the large farms adopted GM technology en masse, it was small farmers who began to use bin-run seed. For while incurring increased labour costs, small farmers were able to seek out niche markets and premium prices that came from an exclusive non-GM soy crop. In other words, the introduction of Roundup Ready® soybeans resulted in a complete reversal in who saved seed on US soybean farms: small farms, seeking niche markets, began to use bin-run seed while large farms, seeking labour and production efficiencies, began to purchase seed from dealers.

To summarise, the expansion of intellectual property rights has been integral in the incorporation of seed into capitalist agricultural production. Furthermore, through the process of licensing seed use, Monsanto has been able to reproduce nature in a capitalist economy—instead of saving seed for use in the next planting season, farmers are now required to purchase seed and, in the case of soybeans, glyphosate, from Monsanto each year. In other words through the use of patents and licenses Monsanto was able to commodify nature and overcome the physical

Figure 3: Percentages of homegrown and purchased soybean seed planted by US farms and enterprise size, 1990

obstacle that the seed had presented to capitalist development of agriculture. This observation is echoed by other scholars like Sarah Whatmore (2002, p. 130), who have convincingly argued that the

startling entrance of GM soybeans had nothing to do with improving the nutritional properties or commercial value of the bean. Rather it signals the increasingly monopolistic impetus of corporate efforts to enroll [sic] the seed into the service of other product lines in the agro-industrial stable.

As this and other research (see Castree 2001) has illustrated, the accumulation strategy of forced combination, or tie-in, of GM soybean seed with herbicide applications, a strategy that David Harvey (2003) has called accumulation by dispossession, has engendered not only a complete reconfiguration of soybean farming practices but also a massive transfer of wealth to the commercial seed industry.

Conclusion

This article has made three important observations regarding the advancement of IPRs and the seed-saving practices. Firstly, seed saving is a long standing global institution, probably as old as agriculture itself. More important is that significant proportions, at times as much as 70 per cent, of soybean varieties have been traditionally grown from homegrown seed. Furthermore, given the new political economic arrangements associated with industrial farming practices, seed saving represents one of the last opportunities for farming independence and income. For example, seed saving provides farmers with knowledge as to how their crop will perform in the following season. It allows farmers to participate in maintaining the crop. It serves as insurance against inadequate supplies of seed and helps to maintain food security. Finally seed saving creates a viable market that ensures that seed remains affordable. For example in 1988, the value for seed planted worldwide exceeded $51 billion (Kidd 1989). Of this amount private firms and public institutions supplied only 63 per cent of this seed. The other sources of seed, amounting to $24 billion, came from saved seed and the buying and trading of seed between farmers.

Secondly, the expansion of IPRs into the seed sector was an effort to encourage private investment in agricultural research and development. Essentially this strategy was an attempt to reduce ‘market failures’ involving the reproduction and exchange of saved seed. However, under the conditions of the technological treadmill, IPRs have created another market failure, one associated with limited monopolies. Attracted by the prospect of patents and patent–like protection for new seed varieties, large multinational corporations did two things: they acquired most major independent seed companies and they began to fund substantial research and development efforts, particularly in new biotechnologies. The result has been a complex imbroglio of name changes, spin-offs, joint ventures and acquisitions.

However, a recent study by researchers at the United States Department of Agriculture found that as the seed industry became more concentrated during the 1990s, private research intensity in biotech maize, cotton and soybeans dropped or slowed down (Fernandez-Cornejo and Schimmelpfennig 2004). According to the USDA report (2004, p. 19), ‘those companies that survived seed industry consolidation
appear to be sponsoring less research relative to the size of their individual markets than when more companies were involved.’ These findings contradict the arguments made by seed breeders that the exclusive rights engendered by patents and patent-like protections would increase innovation in seed technologies. The report also noted that public research support could also stimulate private biotech research and potentially lessen the social and political consequences associated with seed industry concentration and reduced research and development.

Thirdly, expanding intellectual property rights surrounding seed development in the US has made it possible for companies to appropriate the seed-saving portion of the farm production process. The combination of Roundup Ready® soybean seed with a ‘no-replant’ clause has prohibited farmers from legally saving seed and together they have initiated the collapse of the saved soybean seed market. Furthermore, increased demand for GM seed and herbicide applications has driven up the prices of both. The combination of expanded intellectual property rights and GM soybeans has meant that farmers in the US are facing one more element of the loss of control of the farm production process.

**Food for thought**

Some key questions and concerns emerge from this analysis of seed saving in the US. The first, and perhaps most sobering question, is do we want a create an agriculture that is so fragile that only a minute number of farmers and seed breeders have the knowledge and ability to select, maintain and improve seed – a millennia-old tradition and process? As mentioned earlier, the replanting of saved seed is not a routine matter. It requires considerable skill and knowledge. This knowledge is essential for survival in all societies. Frey’s (1996) caveat that the public sector no longer has adequate financing and human resources to educate and train plant breeders is a testament to this fragility. Furthermore recent research by the USDA suggests that the relationship between industry concentration and reduced research and development in seed technologies may translate into fewer varieties being offered to farmers in the future (Fernandez-Cornejo and Schimmelpfennig 2004).

Furthermore, with the exception of the 1930s, the US has had exceptionally long periods without severe civil disturbances or major natural disasters (such as particularly severe weather and global climate change). However, the events of September 11, 2001 show clearly that the US is not invulnerable. Such disasters could easily disrupt input supply chains (Busch et al. 1984). It is essential to domestic food security that (a) farmers already have some saved seed on hand at the time of the natural disaster or civil disturbance and (b) that farmers have the requisite skills needed to properly save that seed – skills that are only maintained if seed can be regularly saved. Without ongoing seed saving on the part of large numbers of farmers, the US population will be unnecessarily at considerable risk.

Currently, all grown crops are cultivated through farmer activity and selection – what Charles Darwin and his colleagues referred to as ‘domestic selection’. However, it appears that the consolidation of the seed-saving industry is narrowing the selection criteria for seed saving to varieties economically viable for a handful of seed companies. If this narrowing continues it will result great homogeneity in domestic crops that are
planted across expansive contiguous areas. And, as demonstrated in the case of the 1972–1973 Southern corn leaf blight, this lack of planted biodiversity can prove to be very costly.

In sum, seed saving is a long standing global institution, probably as old as agriculture itself. It helps farmers control their enterprises and maintain their independence. It allows farmers to know how well a crop will perform in the following season. It serves as an insurance against inadequate supplies of seed. It helps to maintain food security and it creates a viable market that ensures that seed prices remain affordable. The expansion of IPR under the conditions of the technological treadmill, combined with the ‘no-replant’ clause enforced by Monsanto and their partners challenges this history and jeopardises future social nature relations by virtue of its large and growing control over the seed industry.

Notes

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1 Certified seed from either public varieties or private seed companies’ breeding programmes is defined as seed that has passed field inspection and seed testing standards for varietal purity and disease. Non-certified seed is conventionally known as farmer-saved or home-grown seed (Boland et al. 2001).

2 The Kansas Farm Management Association reported that seed costs were 4 per cent of total variable and fixed costs for 589 non-irrigated Kansas wheat farms in 1999 (cited in Boland et al. 2001). As a comparison, in 2003 the cost of soybean seed was $27.42 per planted acre. This accounted for 35 per cent of operating costs and 11 per cent of total costs (includes overheads) (USDA 2004).

3 It should be noted that the Marxist political economy of agriculture scholarship has engendered instructive debate in rural sociology, particularly from neo-Weberian scholars like Patrick Mooney (1983) and from subjectivist perspectives like that of Peter Vandergeest (1988). However, given the article’s focus on the natural characteristics of seed reproduction and the appropriation of this natural characteristic by capitalist agriculture, we felt the Marxist political economy tradition a useful theory with which to frame the empirical content of our article.

4 Among the amendments to the Plant Variety Protection Act in 1994 was the extension of plant breeders’ rights to 20 years.

5 Although the three-tier structure may be an appropriate characterisation of the seed industry, it should be noted that players within the structure, both parent firms and subsidiaries, are being bought and sold at a voracious rate.

6 Expert opinions vary on the value of the global commercial seed market. For example, according to the International Seed Federation, the estimated size of the market for seed and other planting material in 56 selected countries in 2005 was US$25.243 million. However, a July 2005 report by Phillips McDougall, UK-based agribusiness industry analysts, puts the value of Pioneer/Dupont Product Offerings of the commercial seed market at US$19,000 million (ETC Group 2005).

7 The slope of the line from 1955 to 1975 is -0.013.

8 The slope of the line from 1996 to 2002 is -0.023.

9 Production value = production (mill. bu.) × farm price ($/bu.).

10 Total value of bin-run seed = planted area × seeding rate × per cent bin run × seed cost

11 Additional profits = the value of bin-run seed in 2000 × 2.2 [22 per cent/10 per cent] – the value of bin-run seed in 2000.

12 Nominal dollars.
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