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Seeds of hope, seeds of despair: towards a political economy of the seed industry in southern Africa

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ABSTRACT *The seed industry in Southern Africa has been radically transformed by a policy of liberalisation and privatisation started under structural adjustment. Traditionally under the domain of parastatals, seed research, production and distribution has been criticised for failing to provide modern variety seed to smallholder farmers. However, the private companies which have stepped in to replace seed parastatals in southern Africa have proven no more effective in meeting the demands of smallholders. The Trade Related Intellectual Property Rights (TRIPS) Agreement, concluded in 1994 as part of the Uruguay Rounds of GATT negotiations, as well as certain biotechnological innovations such as Terminator or Traitor technologies, threaten to further undermine local seed production and consumption by destroying the informal seed sector so central to agricultural production in the region. What alternatives exist? The success of Zimbabwe's maize seed network offers some insight. Resting on a unique relationship between government and nationally based producer co-operatives, Zimbabwe's maize programme was able to provide nearly every farmer in the country with hybrid maize suited for local growing conditions.*

Advocates of the new agricultural biotechnologies frequently promote the 'biotech revolution' as a panacea for hunger, disease, poverty, development and environmental degradation.[1] Attention is seldom paid, however, to the assumptions and power relations that underpin such positions. More concretely, the flurry of recent activity in agricultural biotechnology[2] is tied to a number of scientific and technical advances[3]—equally important, however, are the processes of political and economic liberalisation underway worldwide. Advances in agricultural biotechnology ('agbiotech') are tied to the conclusion of the Trade Related Intellectual Property Rights (TRIPS) agreement and the expansion of enforcement powers through multilateral institutions like the World Trade Organization (WTO).

This paper focuses on one small part of this coalition of forces, namely the impact of economic liberalisation in the form of structural adjustment and the expansion of international intellectual property arrangements on maize seed networks in southern Africa. It begins by briefly analysing the structures and

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relations surrounding the production, distribution and consumption of seed in southern Africa. The justification for focusing on seed should be obvious: along with fertiliser and water, seed is perhaps the most important determinant of crop success or failure. The genetic information contained in the seed sets the ultimate limit on levels of crop productivity. The use of improved varieties can increase yields, shorten growing seasons, and help ensure against drought. Setting aside the social and economic consequences for a moment, the Green Revolution demonstrates the potential of improved seed varieties to increase yield—in many areas where the Green Revolution has led to the adoption of improved seed, food yields (per person per acre) have doubled or tripled in 20–30 years, more land has been put under cereal cultivation, and shorter maturation cycles have permitted farmers to grow two crops per year (Lipton & Longhurst, 1989). The paper then examines the impact of structural adjustment and the TRIPS agreement on regional and local seed networks, arguing that TRIPS represents the continuation of a policy of liberalisation and privatisation that started in southern Africa with structural adjustment. As such, TRIPS represents a major threat to local seed production and regional food security.

Regional profile

Southern Africa is home to more than 100 million people living in 14 countries.[4] The majority of the population lives in rural areas and the vast majority of the population relies on farming for part or all of their household income. As a result, agricultural production is central to the political economy of southern Africa. Regionally, agriculture accounts for between 5% and 48% of gross domestic product, while providing employment for between 65% and 80% of the labour force. Cash crops account for more than 60% of export earnings in half of the countries of the region (World Bank, 1999a; Abdulai & Delgado, 1995). Even in the more advanced and diversified economies of the region (eg South Africa) agricultural production remains a central component of development programmes and plays a key role in the maintenance of economic stability and political security. Agricultural products are also important regional exports and key raw material inputs for industry.[5]

Given the importance of agriculture in southern Africa, the question of land dominates political and economic discourses. Debates over access to land highlight existing inequalities between town and country, men and women, rich and poor and, in the cases of South Africa and Zimbabwe, between whites and blacks. In both countries, the struggle for independence was based in part on inequality of land distribution. The legacy of settler colonialism left both countries with a small class of predominantly white settlers in control of the vast majority of the most productive land, and large groups of black farmers confined to communal areas comprised of less productive land. Post-independence governments therefore had a vested interest in promoting (at least the perception, if not real) land redistribution.

However, in both South Africa and Zimbabwe land reform has been slowed by government hesitation to endanger agricultural production by introducing extensive or meaningful agrarian reforms. In Zimbabwe already constrained by the

Lancaster House Agreement which granted its independence, the government sought to sustain large-scale (largely white) commercial farming in order to avoid food deficits that would create vulnerability and instability in the economy. Robert Mugabe, an advocate of radical land redistribution during the struggle for independence in Zimbabwe, was forced to concede to the political and economic power of large-scale commercial farmers, and radically scale back land re-distribution programmes. Similarly, the post-apartheid South African government has recognised the need for land reform but has to date been unable to make significant progress towards meaningful redistribution. The South African Department of Land Affairs (DLA) has emphasised the need to redress the injustices of apartheid, which created huge disparities in land ownership, as a mechanism to resolve rural poverty and hunger (DLA, 1996; 1997). However, as in Zimbabwe, land reform in South Africa has stalled in the face of strong opposition by white farmers in the large-scale sector. Unwilling to endanger the sector's productivity which, according to the World Bank, accounts for 95% of South Africa's marketed agricultural output, the South African government has put land reform on the back burner: only 5% of land claims in post-apartheid South Africa have been resolved, and only 2% of South Africa's agricultural land has been resettled (Levin & Weiner, 1997; Kariuki & Van der Walt, 2000). Indeed, in both countries the land question continues to be a source of political tension and economic inequality, as demonstrated by recent farm occupations in KwaZulu-Natal, South Africa, and across Zimbabwe.

Seed networks in southern Africa

In addition to land distribution, access to agricultural inputs (primarily fertiliser, water and seed) is perhaps the most important factor in agricultural development. Seed networks in southern Africa express as much diversity and variation as the region itself. In Angola and Mozambique, for example, the formal seed industry is still in its infancy, while South Africa and Zimbabwe boast very successful seed networks. Unlike seed networks in the West, which are dominated by private corporations, seed production and distribution in southern Africa takes place across a web of public, private and non-governmental agencies and in both formal and informal sectors. The public sector, comprised of government agencies and parastatals, has historically dominated the formal seed sector in southern Africa. Frequently charged with serving all types of farmers, profitability is usually not a primary objective, although, since the introduction of structural adjustment, cost recovery is increasingly important (Friis-Hansen, 2000). Ideally, public networks provide the widest variety of seed in quantities small enough to be afforded by small farmers in communal areas. Practice has shown, however, that, apart from an isolated number of seed co-ops such as Seed Co-op in Zimbabwe, public networks have been unable to provide seed to farmers outside high-potential commercial areas (Cromwell, 1996; Venkatesan, 1994). Private sector activities in southern Africa have been equally limited, frequently confined to seed for which there is extensive demand, usually hybrids which must be replaced at least every second season and which are popular with commercial farmers. Non-governmental organisations are also involved in the

provision of seed to African farmers, although their importance and influence are still limited (Cromwell, 1996).

The second distinction important in southern Africa is between formal and informal seed networks. While 30%–40% of the basic cereal crop seed planted in southern Africa is modern variety, the private, public and non-governmental seed sources which make up the formal seed network provide less than 20% of the overall seed requirements of African farmers, indicating that informal seed networks are important sources of both modern and traditional variety seed (Thompson, 1991; Cromwell, 1996). Small-scale farmers rely heavily on informal seed networks, saving 60%–70% of seed used on-farm, and acquiring 30%–40% from relatives, neighbours and other community sources. Across southern Africa, less than 10% of seed sown by small-scale farmers was obtained from the formal sector (Cromwell, 1996: 20). Instead, informal, community-based seed networks—saving seed on-farm from previous harvests, or acquiring seed from relatives, neighbours or other community sources through barter, social obligation or other exchange mechanisms—provide most smallholder farmers with seed, and therefore represent a key element of agricultural production in southern Africa (*ibid*).

Regional organisations also play a role in the development and provision of new seed varieties. The Southern African Development Community (SADC) encourages the development of a regional seed network that can address the needs of southern Africa. Regionally, maize, sorghum and millet are the most important food crops, representing 77% of cereals harvested and providing the staple food for most of the region's population (Lipton & Longhurst, 189: 2).[6] SADC has therefore focused its efforts on these crops. Through the Southern African Centre for Co-operation in Agricultural Research (SACCAR), it has not only attempted to develop new seed varieties, but has also focused on alternative uses of the crops, particularly sorghum and millet. Indeed, the sorghum/millet programme has led to the discovery

> of alternative uses of the grain in animal feeds, blended flours for biscuits, cakes and buns, and the brewing of beer. Zimbabwe now produces breads using 20 percent sorghum flour, reducing the need to import wheat. Research on sorghum and millet has revealed their suitability for the making of pasta, breakfast cereal, porridge (for weaning also), salty snacks and for paper, cardboard and chipboard. (Thompson, 1991: 87–88)

Because of their focus on regional staple crops, SADC's and SACCAR's efforts are of central importance in ensuring regional food security. Given the sheer scope of their operations, as well as the political power they frequently wield, large-scale commercial farmers have generally been the beneficiaries of government and donor agricultural programmes. Such programmes have historically overlooked small-scale farmer, despite the important role they play in ensuring local and regional food security. The SADC/SACCAR research programme on sorghum and millet, however, recognises the central role of small farmers in improving agricultural production, and rightly focuses on crops important to small farmers but overlooked by the formal seed industry.

The special case of Zimbabwe's maize network

Zimbabwe is unique in southern Africa in its relatively low levels of overall development (*vis-à-vis* South Africa) and its highly developed seed industry (*vis-à-vis* the rest of the region). In maize seed in particular, Zimbabwe's seed programme has enjoyed considerable success. According to a 1989 seed survey, 85% of maize seed used by communal farmers was obtained from the formal sector. Other crops relied more on informal suppliers, as indicated in Table 1.

Since the 1989 survey, Zimbabwe has saturated the maize seed market with modern variety seed, and banned the sale of open-pollinated varieties. As a result, nearly all maize grown in Zimbabwe today is modern (hybrid) variety purchased from the formal seed sector.

Zimbabwe's maize seed breeding programme began early in the twentieth century—its formal breeding programme dates to 1909. Indeed, thanks to a successful research and breeding programme, Southern Rhodesia's[7] maize exports grew at phenomenal rates—between 1909 and 1932 maize exports grew 18.8%, largely as the result of the release of improved, open-pollinated cultivars (Rusike, 1995). Demand for improved maize varieties steadily increased during this period, and the government of Southern Rhodesia responded to this demand by expanding and institutionalising its research and breeding efforts. Although its hybrid breeding programme began in 1932, it was not until after World War II that Southern Rhodesian efforts paid off in the commercial release of new hybrid maize varieties. The success of hybrid cultivars and field trials indicating that hybrid seed outperformed open-pollinated varieties, particularly under low-rainfall conditions, encouraged the government to make hybrid maize available on a large scale. Lacking the resources to produce hybrid maize on a commercial scale, and given the underdeveloped nature of the local seed industry, the government delegated responsibility for the multiplication and marketing of hybrid maize seed to the Seed Maize Association (SMA),[8] leaving government researchers free to focus on the breeding and production of foundation seed. Under the arrangement, the SMA was granted exclusive rights to the production and marketing of government-produced hybrid maize. The success of the arrangement was quickly realised: in 1949 Southern Rhodesia became the second country (after the USA) to produce double hybrid seed,[9] designated SR1, from locally developed inbred lines (Rusike, 1995).

During the 1950s demand for hybrid maize continued to increase, and the government responded by releasing 12 new varieties with higher yield, better

TABLE 1
Source of seed for communal farmers in Zimbabwe (% of farmers)

Source	*Maize*	*Sorghum*	*Groundnuts*
Farm-saved	2	56	72
Community seed system	13	14	18
Formal seed sector	85	25	10

Source: Zimbabwe 1989 Seed Survey, cited in Cromwell, 1996: 95.

grain quality and improved agronomic characteristics. Further, the government of Southern Rhodesia began to recognise the importance of small-scale communal farming. Traditionally, government agricultural policies tended to associate smallholders with subsistence (non-marketed) production. As such, research, credit and extension services were frequently (sometimes exclusively) directed towards large-scale farming operations. But this ignores the important position of smallholder production. Smallholder production accounted for 46% of marketed maize production in 1950, and played a central role in the provision of other crops, particularly millet and groundnut; it contributes to food security through its non-marketed production (Muir & Blackie, 1994). Beginning in 1952 the Department of Native Agriculture purchased hybrid maize from the SMA for distribution to smallholders in five-kilogram packages. Two years later, government researchers began a maize seed breeding programme for lower and less reliable rainfall areas of the country, where, at the time, more than 60% of the arable land under commercial crops was planted with maize (Rusike, 1995). Despite such endeavours, government programmes as a rule continued to be directed to white, large-scale farmers, and the scope of marketed smallholder maize production declined dramatically throughout the 1950s and 1960s, so that by 1965 smallholder output accounted for only 14% of marketed maize production (Muir & Blackie, 1994: 196).

Nevertheless the 1960s marked the solidification of Southern Rhodesia's regional leadership in maize seed breeding and production. In 1960 government researchers released SR52, the world's first commercially available single-cross hybrid. Although intended for higher rainfall and better soil areas of the country, the hybrid proved productive even under less favourable farming conditions. Commercial farmers across southern and eastern Africa adopted the seed, which is still widely grown in many maize-producing areas throughout the world. Following the success of SR52, government researchers released the R200 series of hybrids with improved traits, including early maturation, increased heat stress tolerance and lower rainfall requirements. Designed specifically for the more marginal farming areas of Zimbabwe, the R200 series was also widely adopted by smallholders throughout southern and eastern Africa[10] and, along with SR52, helped to secure Zimbabwe's place as the leading supplier of hybrid maize seed across the region (Rusike, 1995).

In addition to the development of new varieties of hybrid maize, other events of the 1960s helped to shape the development of Zimbabwe's seed industry. First, in 1962 the government transferred the responsibility for the production of foundation seed to the Seed Maize Association and the Farmers' Co-op.[11] This freed the government to focus solely on the development of new cultivars, and placed the finance and management of production and multiplication of seed solely in the hands of the co-operatives which marketed the finished products. Second, the 1964 break-up of the Federation of Rhodesia and Nyasaland,[12] established in 1954, forced Southern Rhodesia's Department of Agriculture to focus on international markets. Sales of seed in Nyasaland accounted for 20% of the SMA's annual sales. With reduced access to the Nyasaland's markets, the SMA turned to US and European markets, and was therefore forced to adopt stricter seed quality standards.

Already a member of the International Seed Testing Association (ISTA), Southern Rhodesia passed the Seeds Act (1965), which tightened standards for registration of seed sellers and testing laboratories, restricted the use of variety names and required maintenance of sales records, seed imports and exports, and certification. The Seed Act also designated the Seed Maize Association as the only official seed-certifying agency and reinforced its *de facto* monopoly over the production and marketing of hybrid maize. Then, in 1965 the Smith government issued the Unilateral Declaration of Independence (UDI). The United Nations responded by imposing sanctions against Southern Rhodesia, inhibiting the entry of multinational seed companies into the Zimbabwean seed industry. Cut off from the rest of the world, the Southern Rhodesian seed industry was forced to diversify production and meet the demands of local markets, encouraging the extensive development of local seed lines and networks.

The UN sanctions primarily targeted Southern Rhodesia's tobacco industry, which accounted for over half (53%) of the country's marketed agricultural output. This forced the Southern Rhodesian government to encourage farmers to diversify their production, and farmers responded by shifting production away from tobacco and towards maize, sugar, cotton, wheat, soybean, coffee, tea and cattle (beef and dairy). By 1980 the country's agricultural production had been extensively diversified, and tobacco accounted for only 20% of the country's marketed agricultural output, indicating that the government had been at least partially successful in its efforts (Muir & Blackie, 1994: 197; Rusike, 1995).

In 1970 the informal arrangement between the Seed Maize Association, the Commercial Farmers' Union and the government was formalised with the establishment of a Tripartite Agreement.[13] Under the agreement, the SMA agreed to produce sufficient maize seed for domestic use and to maintain a strategic reserve of 20% of Zimbabwe's annual maize seed requirements, formalising a practice that began after Southern Rhodesia was forced to import maize seed from South Africa following the 1965 drought.[14] The SMA was also charged with managing seed certification. In exchange, the government granted the SMA exclusive marketing rights over maize lines developed by its breeders.[15] The agreement also allowed for annual reviews of maize prices for the domestic market, and gave the government the right to control maize seed prices and exports. Although not officially barring private competition, the agreement nevertheless undermined potential competition to the SMA by denying access to government subsidised research and germplasm. More importantly, the agreement assured the widespread availability of hybrid maize seed and the maintenance of a national seed reserve in case of drought.

By the time Zimbabwe declared independence in 1980, the seed industry was already producing specialised seed for the capital-intensive large-scale sector. The Tripartite Agreement played an important role in nurturing Zimbabwe's infant seed industry, but the industry was still generally unable to reach smallholders or subsistence farmers in communal areas. Between 1950 and 1980 the government breeding programme released 30 hybrids, fuelling a 45% increase in maize yields (Tattersfield, 1982). By the mid 1970s, 100% of commercial farmers had switched from local varieties to certified hybrid seed, up from 22% in 1950 and 61% in 1966 (Mashingaidze, 1994: 212). However, extensive

government efforts to increase the use of hybrid maize by smallholders had fallen short. Agricultural extension services touted the benefits of hybrid maize, leading to increases in the level of smallholder cultivation, but by 1975, only half of smallholders were growing hybrid maize, and smallholder agriculture accounted for only 12% of total maize production and 12% of total cotton production (Muir & Blackie, 1994: 199). The post-independence government continued to emphasise the importance of hybrid maize for smallholders and prohibited the sale of open-pollinated varieties, while simultaneously instituting price controls on hybrid maize seed. The results were dramatic: by 1990 at least 90% of maize production in Zimbabwe, both commercial and smallholder, was certified hybrid maize, and smallholders accounted for half of all marketed maize and cotton in the country (Muir & Blackie, 1994: 199).[16]

The seed industry under structural adjustment

Before the introduction of structural adjustment policies in the 1980s and 1990s, seed production and distribution in the vast majority of southern African countries was directly under state control. As demonstrated by the case of Zimbabwe, public institutions were the moving force behind research, which was then released either through public sector breeding programmes or public–private enterprises. Parastatal seed companies were created with the assistance of international donors like the Food and Agriculture Organisation (FAO), World Bank and US Aid for International Development (USAID) throughout the 1960s and 1970s. In the 1980s, however, it became fashionable to criticise state enterprises in general as inefficient, mismanaged and unprofitable, and parastatal agricultural organisations in particular as unable to meet the demands of small-scale farmers. Given the generally poor performance of both governments and their parastatals in developing successful seed networks (outside selected cases such as Zimbabwe's maize industry), such critiques were perhaps not unfounded. Across southern Africa, it was becoming clear that large-scale government seed supply organisations were having limited success reaching small-scale farmers outside high potential areas, while growing food deficits and stagnating crop yields further highlighted shortcomings of regional and local seed networks. However, the solution advocated by the World Bank and International Monetary Fund under structural adjustment, namely the complete liberalisation of seed networks and other agricultural services, failed to address the underlying structural problems faced by southern African agriculture. Nevertheless, the central goal of structural adjustment in the agricultural sector was to increase efficiency by removing agricultural subsidies and privatising parastatals. Indeed, structural adjustment programmes frequently demanded the complete liberalisation (read privatisation) of seed multiplication and distribution, restriction of public agricultural research and seed line development, and limitations to the state's regulatory capacity. The results were dramatic across Africa: in Malawi, Monsanto acquired the National Seed Company, the Ghana seed company declared bankruptcy and its assets were divided among other local businesses, Nigerian seed activities were privatised, and foreign corporations took over the management of Mozambique's and Zambia's seed industries. In countries (like Tanzania) that

retained their national seed companies, activities were vastly scaled down (Friis-Hansen, 2000).

Whether or not the liberalisation of the seed industry has improved the efficiency of seed production in southern Africa is a matter open to debate. However, it seems clear that the market mechanism has been no more able to meet the needs of the poorest farmers than the parastatals criticised as the reason for the introduction of structural adjustment in the first place. For-profit research has largely been confined to hybrids, where the farmer is forced to purchase new seed almost every year, as there is little financial incentive for corporations to develop open-pollinated varieties that farmers can save from year to year. Despite the importance of such crops for ensuring regional food security, corporate researchers have largely ignored them. Private seed companies have been hesitant to provide multiple varieties of seed in small quantities desired by smallholders, as doing so increases inventory, storage and transportation costs and reduces economies of scale. Further, the uncertain and fluctuating demands of smallholders farming in marginal areas make forecasting demand difficult and increases wastage costs (Gwarazimba, 2001a). Finally, the ability of farmers to save and multiply non-hybrid seed on-farm allows farmers to go several seasons before purchasing new seed without a significant loss of yield or seed quality (Friis-Hansen, 2000). Indeed, a World Bank study was forced to concede the ineffectiveness of its reforms, concluding that while 'state involvement in the seed trade has declined in many countries, a viable commercial market is not yet filling the gap. In some cases, commercial monopolies have replaced the parastatals', but these have proven themselves no more effective or efficient in the provision of seed than the state-sponsored monopolies they replaced (World Bank, 1999b: 3).

Revisiting the Zimbabwe case after ESAP

The success of Zimbabwe's seed maize industry rested on a unique relationship between government researchers and seed producers. The post-independence government, concerned about foreign intervention and the inequalities created under the colonial regime, focused on policies to foster national self-reliance through a 'Growth with Equity' programme designed to achieve economic growth while simultaneously maintaining development programmes and improving the living standards of Zimbabwe's citizens through free primary health care, primary education and improved working conditions. Some of these policies built on the structures created under the pre-independence Smith regime. In particular, Zimbabwe's seed industry benefited from an environment that restricted foreign competition during the UDI period.

The Growth with Equity programme was at least partially successful. Zimbabwe achieved an average real growth rate of 3.9% per year throughout the 1980s, and GDP per capita grew by 1.4% per year over the same period (Balleis, 1993: 10). But by the mid-1980s the government began to experience balance of payments problems. Hoping to attract foreign investment and stave off structural adjustment, Zimbabwe began to liberalise its economy. However, its efforts were unsuccessful and, as a result, it was forced to turn to the World Bank for assis-

tance, which culminated with the institution of the Economic Structural Adjustment Program (ESAP) in 1990.

Given the high levels of adoption of improved seed varieties, particularly of maize, among Zimbabwe's farmers, foreign seed companies sought to enter the Zimbabwean market even before the liberalisation of the economy. As early as 1981 Pannar set up a subsidiary, PNR Enterprises, in Zimbabwe. A year later, Ciba Geigy began to introduce hybrids from South Africa into Zimbabwe. However, given the extensive protections and barriers established under the Tripartite Agreement, both companies failed significantly to challenge the position of Seed Co-op.[17] The exclusive rights to government maize seed and germplasm afforded Seed Co-op under the agreement, as well as its control over seed certification, ensured the Co-op's dominance of the maize seed industry. The government of Zimbabwe also actively encouraged consumption of Co-op seed. Through the Tripartite Agreement, the government maintained seed prices at levels affordable to most farmers. Extension workers promoted government hybrids, the Agricultural Finance Corporation refused to extend loans to farmers who wished to purchase Pannar or Ciba Geigy seed and, because of apartheid, government officials refused to issue permits to import seed, plants or equipment from South Africa.

When the government began to liberalise the economy, other seed companies were attracted. Pioneer Hi-bred International established a breeding programme in 1985, and introduced new hybrids to Zimbabwe in the early 1990s. In 1987 PNR Enterprises restructured to form Savannah Seeds and produced hybrid maize seed under the Pannar brand name. In 1988 Ciba Geigy withdrew from the Zimbabwean market, selling its genetics to Cargill, who subsequently sold its interests to Monsanto. Today four companies control the maize seed market in Zimbabwe: Seed Co (78.7% market share), Monsanto (8.3%), Pannar (6.5%) and Pioneer (6.5%) (Gwarazimba, 2001b).

Under structural adjustment the government of Zimbabwe was forced to liberalise markets by reducing state interference in the form of price controls, labour regulations and investment restrictions, promote export industries (primarily mining and agriculture), and reduce government spending, particularly on subsidies, parastatals and the civil service (Balleis, 1993). In the seed industry in particular, the government was forced to terminate its relationship with Seed Co-op and open the way for increased competition. It responded by lifting price controls on seed and other agricultural inputs, reducing agricultural subsidies, and opening access to its germplasm. This has led to significant increases in seed price and, as a result, the scope of smallholder consumption of hybrid maize dipped slightly, from 90% to 80% of total hybrid maize seed sales in the early 1990s (Cromwell, 1996).

Enter TRIPS

Following the conclusion of the Uruguay Round of GATT negotiations in 1994, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) entered into force on 1 January 1995.[18] Ultimately, the aim of TRIPS is to strengthen and harmonise national standards of protection of intellectual

property in order to encourage greater international trade. Specifically, the agreement sets out minimum levels of protection to be afforded by member states, including subject matter to be protected, rights conferred to the owner of the intellectual property, permissible exceptions to the rights, and minimum duration of protection. In terms of patent protection, the agreement mandates that member states provide 20-year patents for any inventions, whether products or processes, in all fields of technology without discrimination, subject to the normal tests of novelty, inventiveness, and industrial applicability (GATT, 1995: Article 27.1, Article 33). Members may exclude certain innovations from protection on three grounds: (1) inventions contrary to public order or morality; (2) diagnostic, therapeutic or surgical methods for the treatment of humans or animals; and (3) plants and animals other than micro-organisms and essentially biological processes for the production of plants or animals (GATT, 1994: Articles 27.2, 27.3a, and 27.3b).

Members excluding plant varieties from patent protection must provide an effective *sui generis* system for the protection of new plant varieties. Given that before the adoption of TRIPS most developing countries did not provide protection for plant varieties, there has been an attempt in many such countries to craft a system of protection that affords plant breeders rights while maintaining the right of farmers to save seed.

The TRIPS agreement has generated extensive controversy. While the WTO maintains the agreement's importance in promoting international trade and technological innovation, critics have argued that the agreement represents nothing less than the recolonisation of the Third World. Raghavan, for example, contends that, with the TRIPS agreement, 'industrialized countries are seeking to establish new international rules to protect the monopoly rentier incomes of their TNCs, deny Third World countries access to knowledge, block their capacity for innovation and technical change and prevent any rise in competitive capacity in the Third World' (Raghavan, 1990: 114). While Raghavan may overstate his position, other groups have made similar, though less extensive, claims regarding the potential negative impact of TRIPS. The United Nations Conference on Trade and Development (UNCTAD) argues that:

> The integration of intellectual property rights into the international trading system could mean potential short- and long-term benefits in terms of prospects for enhanced market access and a more conducive framework for foreign investment and transfer of technology … However, it could also generate certain negative impacts, including price increases and restrictions on the diffusion of technology. (UNCTAD, 1997: 1)

For better or worse, the TRIPS agreement will have an extensive impact on relations between North and South. The agreement has the potential to lead to massive restructuring of agriculture in southern Africa, continuing a trend started with structural adjustment. More specifically, TRIPS is significant in at least two ways.

First, as a legal agreement, TRIPS creates a system of proprietary knowledge enforceable to a greater or lesser degree worldwide, expanding the site of surplus extraction in agriculture by restricting the traditional right of farmers to save seed.[19] Historically, the biological nature of the seed limited the extent of com-

modification in the seed industry. As Kloppenburg observed:

> A seed is used up (or rather, transformed) as the embryo it contains matures into a plant. But the end result of that process is the many fold replacement of the original seed. The seed thus possesses a dual character that links both ends of the process of crop production: It is both means of production and, as grain, the product. (Kloppenburg, 1988: 11)

As a result of the dual nature of seed/grain as both means of production and product, after purchasing one generation of seed, farmers are subsequently able to propagate open-pollinated seed for many seasons without any significant loss of yield potential or characteristics.[20] Thus,

> There is little incentive for capital to engage in plant breeding for the purpose of developing superior crop varieties, because the objective in which that research is valorized—the seed—is unstable as a commodity-form. The natural characteristics of the seed constitute a biological barrier to its commodification. (*ibid*)

In this respect, the TRIPS agreement represents an attempt to expand the site of surplus extraction in agriculture by overcoming the biological limitation to the commodification of seed through legal restrictions on its use. Such restrictions would invariably undermine the southern African informal seed networks, the most important source of seed for small-scale farmers who produce the majority of food consumed in the region, by making it more difficult and expensive for farmers to save seed, and making it illegal to trade seed with neighbours. Given the importance of informal seed networks in southern Africa, any attempt to undermine traditional practices of saving and exchanging seed therefore represents a serious threat to regional, national and local food security.

Defenders of TRIPS frequently contend that farmers are not forced to pursue new varieties of seed, that, if they prefer, they can 'vote with their pocketbooks' to retain traditional varieties.[21] Such a position, however, is problematic. It assumes that there exists sufficient competition for farmers, as consumers of seed, to have a choice in their purchases. Given the increasing consolidation in the agbiotech industry over the past several years,[22] this may or may not be the case. Further, farmers may not have a choice in their decision to adopt the technology. If neighbours adopt new varieties, other farmers may be forced to adopt similar technology or fall behind. If crop yields increase significantly, prices for agricultural commodities will fall, benefiting consumers but harming small producers, particularly those who failed to adopt the new higher yielding technologies. A similar phenomenon was witnessed during the Green Revolution, when economic pressures forced farmers to adopt expensive Western technologies while simultaneously driving down the prices of agricultural commodities. Eventually, these converging trends facilitated consolidation of land ownership by forcing small farmers to sell land to larger farmers who enjoyed economies of scale. While this process may have increased overall agricultural output, it decreased levels of food security among rural smallholders by dispossessing them of their primary means of livelihood—their land (Shiva, 1991).

Finally, the 'vote with their pocketbooks' argument assumes farmers know they are planting patented varieties in the first place. It is possible, through cross-

pollination with non-GM crops, for farmers to unwittingly violate the TRIPS agreement. Further transnational seed corporations have not always been forthcoming in their relations with governments of developing countries. In 1996, for example, the Zimbabwean government learned that Monsanto, in league with the Commercial Cotton Growers Association (CCGA), which had been pushing for local use of Monsanto's Bt cotton for a number of years,[23] had illegally smuggled genetically modified cotton into Zimbabwe for field trials. When the government discovered the field trials (just before harvesting), which violated both the Plant, Pests and Disease Act in Zimbabwe's temporary ban on the planting of genetically modified seed, it ordered the crops uprooted.

In addition to commodifying the seed, TRIPS allows for the privatisation of the benefits of biotechnology while socialising its risks and costs. Advances in biotechnology draw directly from the biodiversity of the South and thousands of years of trait selection and development by farmers. Modern varieties build upon, but do not compensate, the efforts of farmers whose knowledge and work is embodied in the seed. Instead, under TRIPS only 'modern' technologies are rewarded. The germplasm and biodiversity of the South are treated by the agreement as the 'common heritage of mankind', while the agbiotech products created based on this knowledge are considered innovations and rewarded with monopoly rents, thereby pricing new seed varieties out of range of most African producers. Germplasm flows from the resource-rich South to the capital-rich North are uncompensated. However, according to one estimate, if the USA were forced to pay royalties on imported biological resources, it would owe $302 million for agricultural products and $5.1 billion for pharmaceuticals (RAFI, 1991). According to Mooney, 'The perception that intellectual property is only recognizable when produced in laboratories by men in lab coats is fundamentally a racist view of scientific development' (Mooney, 1988: 1).

Ironically, the simultaneous socialisation of risks/costs and privatisation of benefits under TRIPS is possible only because of a paradox in the industry's position regarding the nature of its products. For regulatory purposes the biotechnology industry maintains that its products are 'substantively equivalent' to non-GM products. As such, it contends that its products should be regulated just as its non-GM equivalents are regulated—Bt cotton and non-GM cotton are treated as the same product for regulatory purposes, as are Roundup Ready soybean and non-GM soybean. But in terms of patent protection, the industry position is that biotech products are 'novel' and represent an 'innovative step' over their non-GM counterparts, and should thus be protected as the intellectual property of their owner, and benefit from the monopoly pricing afforded such innovations.

The TRIPS agreement may even undermine World Bank strategies for the development of the seed industry in southern Africa. The Bank has recognised the importance of the informal seed sector in African agriculture, arguing that 'robust informal seed systems linked with competitive, commercial seed enterprises operating in regional markets are critical [in] improving small farmer access to productive seed' (World Bank, 1999b: iii). Such a system can only develop, according to the Bank, 'given an appropriate enabling legal framework' (*ibid*: 4). However, TRIPS mandates a 20-year period of patent protection for new plant varieties. Any lesser protection could be challenged and overturned by the

WTO, and would certainly evoke reprisals from the USA under Super 301, making even the most modest proposals for seed security envisioned by the World Bank impossible.

Conclusion

If structural adjustment has further weakened already fragile African seed networks, and the TRIPS agreement threatens to undermine even the modest proposals of the World Bank, what remains? The success of Zimbabwe's maize industry before the introduction of structural adjustment provides some insight. Zimbabwe's success rested on a unique relationship between government and nationally based private co-operatives, in which the government provided access to subsidised research and improved varieties of hybrid maize, and the producer co-operative ceded control over pricing and maintenance of strategic seed reserves to the government. While such a strategy smacks of heresy in the current neoliberal era, its successes cannot be denied: widespread adoption of hybrid maize with improved characteristics even by the poorest of Zimbabwe's farmers, higher crop yields and increased food security. Although Zimbabwe has been unable to translate its success in maize seed production to other areas (and although even its previously strong maize seed network has been weakened by structural adjustment and TRIPS), its limited success nevertheless points to potential strategies for other countries of southern Africa.

Recognising the importance of the informal seed sector (and accompanied by a redistribution of government resources to reflect this importance) a two-tiered seed network in which the formal seed network provides improved varieties to large-scale producers, and an informal network ensures appropriate, improved varieties are available to smallholder farmers, is fundamental to the development of African agriculture. Such a system would be capable of distributing the benefits of new seed technologies to farmers, while simultaneously ensuring that the problems of risk socialisation/benefit privatisation associated with the current biotech regime are mitigated. A combination of formal and informal seed networks appears to provide the greatest level of seed security, and thus food security, to the greatest number of farmers in southern Africa.

Notes

[1] See, for example, the Council for Biotechnology Information (2001), an industry advocacy group founded by Aventis, BASF, Dow, DuPont, Monsanto and other biotech corporations. The US Department of State has taken a similar position. See, for example, *Healthy Harvests: Growth Through Biotechnology* (2000).

[2] Biotechnology is understood here as including any technique that uses living organisms (in part or in whole) to improve plants or animals, modify products, or develop organisms for specific purposes. This definition includes a whole spectrum of processes, from simple plant breeding to recombinant DNA processes.

[3] For a discussion of these scientific and technological advances, see Grace (1997).

[4] For my purposes, southern Africa includes the 14 members of the Southern African Development Community (SADC) namely: Angola, Botswana, Democratic Republic of the Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.

[5] For example, food and raw agricultural materials comprise 15% of all exports of the Southern African Customs Union (composed of South Africa, Botswana, Lesotho, Namibia and Swaziland), 57% of Zimbabwean exports, 78% of Mozambique's exports, and 92% of Malawi's exports (World Bank, 1999a: 204–206).

[6] Indeed, the difference in cereal production between Asia and Africa has been pointed to as a reason for the exclusion of Africa from the Green Revolution. In Asia, rice and wheat, the two crops on which the Green Revolution centred, account for 80% of cereal production, while in sub-Saharan Africa rice and wheat account for only 13% of cereal harvest. As such, Africa did not benefit from the increasing yield levels in these crops facilitated by the Green Revolution (Lipton & Longhurst, 1989).

[7] Until independence in 1980, Zimbabwe was known as Southern Rhodesia.

[8] The Seed Maize Association was established in 1940 to produce maize seed for its members. Until its creation, farmers obtained small amounts of sample seed directly from government research stations, and had to multiply and maintain their own seed stores on-farm. The SMA centralised and certified seed multiplication for its members, facilitating economies of scale in seed production. Seed associations for other crops, such as tobacco and potatoes, soon followed.

[9] A single-cross hybrid is developed from crossing two inbred lines. Crossing two single-cross inbreds develops a double-cross hybrid. Crossing a single-cross hybrid with an inbred line develops a three-way or triple-cross hybrid.

[10] R200 and R201, in particular, as still used by smallholders in the region.

[11] Breeder seed is seed directly controlled by the originating or sponsoring plant breeder. It is the most genetically pure seed, and is used by breeders to produce foundation seed. Foundation seed is seed produced from breeder or other foundation seed, and is used to multiply (certified) seed for distribution to farmers.

[12] Nyasaland was the colonial name for Malawi.

[13] Similar agreements have been reached for other crops, including sorghum, sunflower and groundnut. However, these arrangements have to date been less successful than the maize seed programme in ensuring adequate supplies of modern variety seed at affordable prices for all farmers (Tattersfield & Havazvidi, 1994: 118).

[14] The use of strategic reserves of maize seed protected Zimbabwe during the 1992–93 drought when, even under drought conditions, the country had a 20% maize seed carryover (Tattersfield & Havazvidi, 1994).

[15] In an effort to expand its seed line varieties, Seed Co-op established the Rattray Arnold Research Station outside Harare in 1973. Funded by the Co-op, the station maintains its own plant breeding and testing programmes, complementing government research efforts. In addition to maize, the station focuses on soybean and wheat.

[16] Indeed, the success of Zimbabwe's maize programme is demonstrated through yield comparisons with South Africa. While South Africa is considerably more developed than Zimbabwe, maize yields in Zimbabwe outperform those of South Africa. Commercial yields average around 4.0 tons per hectare in Zimbabwe, compared with 2.5 tons per hectare in South Africa. Smallholder yields in Zimbabwe are roughly 0.7 tons per hectare, compared with 0.5 tons per hectare in South Africa (Cromwell, 1996; Rusike, 1995).

[17] Seed Co-op grew directly out of the Seed Maize Association. In 1980 the SMA merged with the Seeds Co-operative Company Limited and formed the National Seed Company of Zimbabwe, which took over the functions of both companies under the Tripartite Agreement. In 1983 the SMA merged with the Seeds Co-operative and formed the Seed Co-operative Company of Zimbabwe, or Seed Co-op.

[18] Under the terms of the agreement, developing countries are afforded a transition period of five years before they are required to have TRIPS-compliant legislation in force. The least developed countries are afforded an 11-year transitional period. Article 70.8, however, requires that countries afforded a transition period provide immediate patent protection for pharmaceutical and agricultural chemical products.

[19] Ironically, recent advances in biotechnology may make TRIPS irrelevant in this respect. Monsanto's 'Technology Protection System' (TPS), dubbed 'Terminator Technology' by its critics, encodes intellectual property protection at the genetic level by creating seeds that cannot reproduce. Although public pressure forced Monsanto to withdraw its TPS, it has already begun work on a second generation of the product, dubbed 'Traitor Technology'. Crops containing the second-generation technology will fail unless sprayed with chemicals obtained from the seed suppliers (RAFI, 2001).

[20] An exception to this is hybrid seed, which does not breed true and must therefore be purchased each year to maintain crop characteristics and yield levels. This factor explains the emphasis private sector research places on hybrid crops, and the extensive development of the commercial hybrid sector starting early in the twentieth century.

[21] The US biotech industry has taken a similar position, in which it argues that public (read consumer) acceptance, not government regulation, should be the final arbiter of levels of genetically modified

organisms (GMOs) in particular products. Ironically, the same group opposes labelling products containing GMOs, thereby denying the consumer the information necessary to make an informed decision.

[22] The top 10 seed companies control over 30% of global seed sales. Particular sectors are even more consolidated: the top five vegetable seed producers account for over 75% of global vegetable seed sales; four companies (DuPont/Pioneer, Monsanto, Novartis and Dow) control 69% of the North American maize seed market and 47% of the global soybean market; Monsanto alone controls 87% of the US cotton seed market. Three companies, Monsanto (88%), Aventis (8%) and Novartis (4%) account for virtually all transgenic seed crops planted in the USA, the world's largest agbiotech market, representing over 80% of global production of GM crops (RAFI, 2000).

[23] Monsanto's Bt cotton is produced by inserting the Bacillus Thuringiensis (Bt) gene, a natural pesticide that wards off bullworms that feed on cotton plants, directly into the cottonseed. Critics contend that Bt cotton could facilitate Bt-resistance in bullworms and other pests, while simultaneously undermining cotton biodiversity through cross-pollution with non-GM varieties.

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