From Farmer Participation to Pro-poor Seed Markets: The Political Economy of Commercial Cereal Seed Networks in Ghana

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Abstract The current agricultural policy discourse in Ghana emphasises 'pro-poor market' approaches to seeds and input delivery systems by creating public–private partnerships and an enabling environment for agri-business. This has resulted in a particular configuration of actors and interests that define the country's emerging Green Revolution agenda, of which certified seed is a critical component. This article draws on the results of a political economic analysis of Ghana's cereal seed system to examine how influential alliances of public and private actors have constructed a particular vision of the future of agriculture in the country which serves a narrow set of political interests and constrains local innovation and opportunity in the seed sector. It highlights how this universalising 'consensus' is acting to close down efforts to establish more pluralistic, participatory approaches in favour of a single, dominant, commercially oriented model of agricultural development.

1 Universalising visions, excluded voices

Since the 1980s, public research systems in seed production in sub-Saharan Africa have increasingly come under pressures to privatise. The state has been transformed into a regulator of seeds and a catalyst for the emergence of seed markets. These policies vary in different African states. In some countries, the privatisation of the seed industry has been relatively simple, as private investment has moved to replace the state and run viable large private seed companies. In others, such as Ghana, this has not been the case and divestiture of the seed industry has not seen the emergence of large private seed companies. Where farmers largely depend upon their own seeds and are reluctant to purchase improved seed, privatisation has often been complex and fragmented. In the Ghanaian case, with few large investors willing to invest in an industry that has not yet established itself, the development of investment in seeds is predicated on creating an enabling social infrastructure for seeds, which gradually builds demand among farmers and integrates them into seed, input and food processing markets.

These developments involve the building of dense networks of civil society and social service providers who engage in social networking to build 'pro-poor markets'. They actively work to facilitate the uptake of seeds by provision of training, microcredit, building organisational skills and linkages, and disciplining farmers to accept food chain governance, consisting of regulated production, contractual relations between farmers and industry, and adherence to quality standards and grades (Ponte and Gibbon 2005; Dolan and Humphrey 2000; Gereffi 1994). They extend many of the organisational innovations made in the sphere of horticultural exports to food production. These civil society networks are mobilised around policy assumptions and narratives about the superiority of modern seeds and inputs, and their capacity to empower farmers through solving hunger and poverty, and raising farmer incomes. The mutual reinforcement of this agenda by donors, civil society actors and private capital leads to a process of mobilising consent that excludes voices that do not share this universalising vision of agri-business domination. This is based on

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assumptions about the performance of modern varieties and their inherent superiority, however, and given that less than 5 per cent of farmers in Ghana regularly purchase certified seed, these developments are in danger of introducing a hegemonic process that could lock small farmers into an agri-business treadmill.

Although the expansion of the market can result in creating new choices and freedoms for rural producers, it can also lead to trade monopolies and expropriation of the resources of the poor, including intellectual property rights, the erosion of local varieties, the denial of farmers of rights to store and multiply their own seed and the forceful integration of the powerless into alienating markets that offer them little sense of security.

The expansion of these market-based approaches tends to displace public spaces for participation in policy dialogue and critiques of commercial development and notions of social learning for sustainable futures. In its place, market integration is conceptualised as a major force for expanding options for the poor, including access to new technologies, higher yields, higher incomes and wealth. The professed urgency of solving the food crisis in Africa and narratives about creating a new Green Revolution of miracle high-yielding varieties adapted to marginal environments has brushed aside the agro-ecological critique of the Green Revolution and technology transfer. Knowledge becomes configured as a possessed entity resulting in new commodities with intellectual property rights (Amin and Cohendet 2004; Kloppenburg 1988), rather than as social learning in a participatory agricultural research agenda (Ashby 2009; Richards, 2009; Altieri 2002; Röling 1988).

This article examines the discourses and organisational forms involved in the building of 'pro-poor market' approaches to seeds and input delivery systems in Ghana within the policy framework of creating public–private partnerships and enabling environments for agri-business. It traces these developments in the context of the historical transitions in cereal seed policy in Ghana from independence to contemporary neoliberal market initiatives. It combines a political economy analysis, which examines dominant political interests in the seed industry, with an actor network approach examining the various alliances and discourses mobilised to bring about change and the commodification of seeds. It is based on interviews carried out with various actors in the chain of production and use of seeds from farmers, researchers, seed-breeders, seed-growers, agro-dealers and NGOs in 2009–10 (*cf.* Amanor 2010).

2 From statist agriculture to commercial estates and the 'encadrement' of the peasantry

Since its independence in 1957, the Ghanaian state has been committed to agricultural modernisation. This has involved the creation of an agricultural service infrastructure to promote mechanised agriculture, the use of synthetic inputs, scientifically improved varieties of certified seeds generated on research stations, and cultural recommendations worked out on experimental stations. This vision of agricultural modernisation has taken various forms under different governments in relation to their ideological commitments, their political alliances, and shifts in the paradigms of international development.

Under the Nkrumah-led Convention People's Party (CPP), the Ghanaian government promoted state investment in agricultural production, embodied in State Farms, Workers' Brigades and Cooperative farms. This mainly focused on mechanised food production away from the forest zone. State investment in food production was partly motivated by the need to ameliorate the increasing national expenditure on food imports during a period when cocoa prices were falling on international markets. State production of food focused on the opening up of new commercial agricultural frontiers in the Northern Region and within the transitional zone of the northern Brong Ahafo and Ashanti regions. The low population density in these areas enabled large state farms to be created without the expropriation of large numbers of peasant farmers. This was a highly experimental form of agriculture, since the technical recommendations for agricultural modernisation under tropical African conditions were in their infancy. While most of the agricultural budget was spent on the state sector, it did not make a significant contribution to total food production, which was still largely based on smallholder production (Konings 1986).

Following the 1966 *coup d'état*, when Nkrumah was overthrown by members of the National

Liberation Council, agricultural policies turned towards promoting large-scale private estate agriculture. This followed the Green Revolution approaches of the UN Food and Agriculture Organisation (FAO) and United Nations Development Programme (UNDP) of that period, initiated under the Focus and Concentrate Programme, which targeted large 'progressive farmers', who became the recipients of subsidised tractors, inputs and low-interest loans. These policies continued through the various political transitions of the 1970s, with government facilitating agricultural investment for fractions of the political, bureaucratic and military elite (Konings 1986). Subsidies on fertilisers rose from 50 per cent in 1971 to 81 per cent in 1976 (Shepherd and Onumah 1997). By the 1970s, a significant sector of large estate capitalist farmers had emerged in rice production in northern Ghana and in maize production in the transition zone of Brong Ahafo and northern Ashanti. In this period, the state also became interested in controlling peasant production through a policy of 'encadrement' (Konings 1986). Peasant farmers became integrated into government-sponsored projects in which they would receive land (including irrigated land), inputs and seeds, and agricultural services (such as ploughing and water). In return, farmers were contractually obliged to cultivate particular prescribed varieties of crops with cultural practices outlined by project extension staff, and to sell their produce to parastatal marketing organisations. This new interest in smallholder agriculture partly reflected the interests of donors such as the World Bank in promoting commercial smallholder agriculture and contract farming (Daddieh 1994; Watts 1994). It also reflected the increasing lack of viability of large estate agriculture. During the erratic climatic conditions of the 1970s, large-scale commercial farming became increasingly risky and unable to solve the problem of feeding the cities. Government began to turn towards smallholder farmers, but also to joint financing arrangements with international agri-business (Jonah 1980). This reflected the increasing failure of the large private commercial farmers to remain economically viable, as many were unable to pay back loans taken from the banks (Konings 1986; Delimini and Wobil 1998; Shepherd and Onumah 1997). This exacerbated a looming financial crisis, resulting in the insolvency of banks and forced the government to apply for assistance from the International Monetary Fund (IMF), resulting in the implementation of austerity measures under a Structural Adjustment Programme.

During the colonial period, little investment had been made by the Gold Coast state in developing cereal seed-breeding programmes. While a network of experimental stations was created during the late 1940s, seed breeding essentially developed during the post-colonial era. Seed breeding made rapid strides during the 1970s, as state agricultural policies became more aligned with international development prescriptions, resulting in expanded links between Ghanaian agricultural research, the World Bank and international agricultural research centres.

These relationships provided Ghanaian seed-breeding programmes with access to a wide variety of international genetic materials (including many farmer varieties), training opportunities abroad and intellectual exchange with international centres and international programmes. They also enabled Ghanaian seed-breeders to screen international accessions to identify varieties with potential to perform well in different agro-ecological conditions in Ghana and cross them with local and other varieties, in adaptive trials for particular agro-ecological conditions. By the late 1970s, two distinct seed research complexes had developed – the first at the Crop Research Institute (CRI) in Kumasi, concerned with seed breeding for the southern forest zone, and the second at the Nyanpala Research Station, which later became the Savanna Agricultural Research Institute (SARI), focusing on adapting seeds to northern savanna conditions.

In 1979, this research capacity was further enhanced with the initiation of the Ghana Grains Development Project (GGDP), with support from the Canadian International Development Agency (CIDA). This created a new institutional research structure for the improvement of cereal crops and legumes, which addressed plant breeding within a multidimensional context. This included the development of a Farming Systems Research (FSR) framework, and the initiation of participatory on-farm trials to adapt varieties and recommendations to farming conditions and farmer priorities. This facilitated the rapid release of new varieties during the 1980s and 1990s (Tripp and Marfo 1997). Although there was a concerted attempt to adapt seed

programmes to farming conditions, the approach was still fashioned within an overriding transfer of technology framework. The new varieties worked within the parameters of a set of standardised cultural recommendations, which emphasised response to applications of synthetic fertilisers.

3 Structural adjustment, neoliberalism and the privatisation of seeds

The successes achieved in public plant breeding during the late 1970s were undermined by the imposition of strict structural adjustment policies in the 1980s. Ghana's fertiliser distribution and certified seed industries were privatised and in 1989, the government ceased procuring, distributing and subsidising fertiliser. Consequently, prices of fertilisers increased rapidly, reflecting the high rates of inflation brought about by a free-floating currency, which averaged around 25 per cent per annum during the 1990s. Agricultural credit also attracted high rates of interest of 30–40 per cent during this period. As a result, fertiliser usage dropped significantly among small farmers who were unable to afford the cost. Imports of fertilisers fell from 59,000 tonnes in 1979 to 20,000 tonnes in 1986 and fluctuated between 35,000–55,000 tonnes per annum during the 1990s (Shepherd and Onumah 1997). The decline of fertiliser use had a marked impact on the uptake of new seeds, since their potential higher yields were only achieved with the recommended fertiliser application. Thus, at the very period when the state seed industry had developed the capacity to breed certified seeds, the production of certified seed was constrained by macroeconomic reforms.

The cereal seed sector became subject to privatisation during the 1980s. The privatisation of seeds was complicated, since initiatives undertaken prior to structural adjustment had resulted in support from the US Agency for International Development (USAID) for the creation in 1980 of a parastatal company, the Ghana Seed Company (GSC), which was responsible for the multiplication and distribution of certified commercial seed. Essentially, the development of the GSC led to the division of cereal seed production into two distinct wings: a public sector in which breeders created new varieties and distributed breeder seeds to the Ghana Grains and Legumes Development Board (GGLB) for multiplication into foundation seed; and a commercial sector under the GSC, in which foundation seed was multiplied into certified seed for sale to farmers.

Although GSC was created as a parastatal company with donor funding, it came under considerable pressure to privatise. While the GSC received substantial donor funding, the crop research centres and the GGLB were underfunded. As a consequence, the GGLB failed in its mandate to provide the GSC with sufficient quantities of foundation seed and the operations of GSC was plagued by problems of seed quality, low outputs of seed and poor returns on capital investment (Tripp and Marfo 1997). In 1989, the GSC were closed down and restructured. However, private sector investors were unwilling to take over the company and the botched privatisation resulted in the fragmentation of GSC into an association of seed-growers, who were originally employed or contracted by GSC to provide certified seed.

The Seed Producers' Association of Ghana (SEEDPAG) constitutes a network of registered seed-growers. They depend upon the remnants of the infrastructure of the Ghana Seed Company to provide them with the facilities to dry and process their seeds. Within the state sector, the GSC have been reconstituted as a regulatory body known as the Ghana Seed Inspection Division (GSID), which has the responsibility for monitoring and regulating the production of certified seed and registering members of SEEDPAG. The private seed-growers still depend on the state, however, since the processing of seeds is heavily subsidised. Many seed-growers also depend on the state to provide them with contracts for seed production from state-led development programmes.

4 The role of NGOs in the commercialisation of seeds

With the contraction of public agricultural services and rise in input prices during the late 1980s and 1990s, the future of commercial seed production in Ghana appeared bleak, until 1986, when Sasakawa-Global 2000 (SG 2000) stepped in to the picture, to encourage and facilitate the uptake of seeds and inputs by farmers. SG 2000, an international NGO, was supported by the Sasakawa Africa Association (led by industrialist Ryoicho Sasakawa, the Chairman of The Nippon Foundation, Japan) and the Carter Center, USA (led by Jimmy Carter, former President of the

United States), and designed by Norman Borlaug, one of the architects of the Asian Green Revolution. In Ghana, the SG 2000 programme initially focused on promoting new varieties of maize and sorghum, produced by Ghanaian research centres. It distributed seed and input credit packages to farmers, with low interest rates (Breth and Downswell 2003; Puplampu 2003). SG 2000 initially worked with government extension services and established large demonstration plots in which farmers were encouraged to compare the performance of improved varieties and inputs against their own cropping practices. Although SG 2000 distributed large quantities of seed and inputs, many farmers reverted back to low input cultivation when the three years of credit offered to them expired. By 1989, SG 2000 began to experience difficulties in loan recovery and by 1990, only 45 per cent of loans had been recovered (Breth and Downswell 2003).

With the privatisation of seed production in 1990, the SG 2000 programme was modified and began to work with the GSID to help develop its network of private seed producers. During the 1990s, SG 2000 was important in providing a source of demand for the seeds of SEEDPAG members. The programme began to promote private input dealers and in 1991, a new credit scheme was introduced, involving the Agricultural Development Bank (ADB), and input dealers. Registered farmer groups received input packages from approved suppliers who were remitted by the ADB. After harvest, the farmers' groups were responsible for repaying their loans as a group, and further loans were dependent upon repayment by the whole group. The programme began to falter in the mid-1990s, as SG 2000 funding of the transaction costs of the programme declined and inputs became more expensive to purchase. With increasing difficulty in recovering loans, the programme was closed down in 2003. From 1986–2003 it has been estimated that SG 2000 spent about US$20 million on its programmes in Ghana. Although the programme failed to create stable conditions for continued use of seeds and inputs by small farmers, it was important in generating a demand for certified seed over the period in which agricultural services were divested and reorganised on a commercial basis. The SG 2000 programme ensured that commercial seed-growing activities remained intact, and weaned seed-growers away from government patronage (Breth and Downswell 2003; Dawson 2002; Puplampu 2003, World Bank n.d.).

The decline of SG 2000 paved the way for more comprehensive initiatives to arise around the concept of promoting a new 'African Green Revolution'. These go beyond the gap-filling NGO strategies of SG 2000, to a far more complicated and ambitious programme of building state, civil society and private sector initiatives to fashion new input and seed markets and industries and a business environment. This approach aims to generate demand for inputs among farmers by building an efficient commercial delivery system based on improved research products and a network of input dealers, agro-dealers and seed companies with an increased presence in the deep rural hinterland. This provides subsidies to commercial dealers and absorbs some of the transaction costs of commercial development. It is argued that inputs are expensive in Africa because of weak demand and poor market linkages. Thus, the underlying assumption is that the provision of aid to commercial sector actors to reorganise delivery systems and 'smart' subsidies for lowering transaction costs and providing cheaper inputs to farmers will stimulate demand among smallholder farmers and enable a critical mass market to be built up, which will then lead to more competitive prices for farmers. Important advocates of this approach include the Millennium Villages Project of the United Nations, the Millennium Challenge Corporation (MCC), a foreign aid agency of the USA, which disburses large grants to African states for commercial seed and input promotion, and the Alliance for a Green Revolution in Africa (AGRA), an NGO with considerable support from the Bill and Melinda Gates Foundation and the Rockefeller Foundation.[1]

5 Social networking to promote seed markets and agri-business value chains

Since the early 2000s, a new framework for the development of private seed markets has come into being in Ghana. While building upon the SG 2000 initiatives, this contains several distinct new elements. In place of one prominent NGO facilitating the uptake of seeds, the new structure consists of a dense network of hierarchically organised NGOs and government services and programmes, all working in synergy

to facilitate the emergence of seed markets. Some of these NGOs are involved in training farmers in agricultural technology, in providing training in agri-business organisation, in quality control and standards, value added processing, in the training of other NGOs, in promoting value chain analysis and linking farmers with agro-industries. The main actors facilitating these developments in Ghana have been AGRA, MCC and the International Fertilizer Development Center (IFDC), a non-profit public international organisation (PIO), closely associated with the fertiliser industry.

In 2002, the IFDC published An Action Plan for Developing Agricultural Input Markets in Ghana (IFDC 2002).[2]

This report provides a framework for supporting the expansion of private sector initiatives in seed and fertiliser distribution by building the necessary human resources, marketing infrastructure and financial support services to facilitate the emergence of networks of agro-dealers and commercial input distributors and enable input dealers to lower the transaction costs of input procurement. The report specifically recommends promotion of hybrid seed as a technology transfer option over open-pollinated varieties (OPVs) to achieve higher yields and the development of contractual relations between farmer associations and agro-processing firms as a means of creating reliable demand for high-quality grain to ensure 'sustainable' use among farmers. The IFDC advocates building up a network of training facilities to educate farmers on contracts, quality control, improving access to market information and developing farmers' associations. The IFDC approach is essentially based on promoting the integration of small producers into agri-business chains through building a social marketing infrastructure of human resource training, information and financial services to facilitate incorporation into input markets and agro-industrial markets, and educating farmers on normative forms of agri-business organisation. This involves creating linkages between private and public sectors, and the contracting of human resource development and social networking to NGOs. This has further evolved into a framework of food chain governance, through introducing barriers to entry, upgrading of production, quality controls and value chain analysis.

In 2006, the Millennium Development Authority (MiDA) was inaugurated in Ghana to oversee the implementation of the Millennium Challenge Corporation's objectives in Ghana. The MCC provided Ghana with US$547 million for agricultural programmes in 23 districts in the deprived districts in Northern Region and the Afram Plains, but also in the horticultural export belt of southern Ghana. MiDA works with the national agricultural extension services to train farmers and provides them with packages of certified seed and inputs. AGRA is also supporting the development of research capacities to generate new commercial varieties, including hybrid seeds. It is supporting the development of a West African regional plant-breeding centre at the University of Ghana with biotechnology capacities. It provides grants for the development of commercial seed companies in Ghana, and of networks of agro-dealers in collaboration with MiDA and IFDC. This has facilitated a small select group of seed-growers and staff working within crop research institutes to use their knowledge to access grants for the building of commercial seed companies, such as the Savanna Seed Services Company in Tamale. AGRA is also developing initiatives around promoting seed law reform to support commercial property rights in seeds.

These large philanthropic foundations and development agencies have set the main parameters for new seed initiatives in Ghana around which a dense network of international and local NGOs work to implement programmes that build linkages between farmers, agri-business, commercial seed producers, agro-dealers, input distributors and financial intermediary services. In the Northern Region, US NGOs, including ACDI/VOCA (which works through the USAID-sponsored Agricultural Development and Value Chain Enhancement Project (ADVANCE) and Technoserve), and the Ghanaian Association of Church Development Projects (ACDEP) are prominent in linking farmers to agro-industrial food processors. They have organised training for farmers' groups to produce high-quality cereals for the food processing industry and provided access loans to farmers to help them purchase certified seeds and inputs. Some NGOs have established subsidiary organisations focused on marketing. For example, ACDEP, an NGO originally providing appropriate agricultural services for

the rural poor (Alebikiya 1993), has now established the Savanna Farmers Marketing Company Ltd (SFMC) as a private company that links farmers with agri-business.

Several private companies are also creating their own farmer associations to promote the uptake of inputs and lower transaction costs. Wienco, the largest private fertiliser distribution company in Ghana, has established Masara N'Arziki, a farmers' association that organises farmers' groups to receive seed and input packages, technical advice and credit, and links farmers to the food processing industries. Masara N'Arziki is also supported by a large number of input suppliers, each of whose inputs are provided to farmers through the project on credit.

These developments reflect a pronounced shift in NGO activities from community food security and income generation to linkages with agri-business. While these linkages aim to gain better prices and stable markets for farmers by overcoming entry barriers (Dawson 2002), they have also transformed the relation of farmers to input production. NGOs have now moved their priorities from supporting communities with training in multiplying their own seed, to encouraging them to plant certified seed. Thus, these NGOs are essentially contributing towards the creation of a social infrastructure of business services to facilitate the integration of smallholder farmers into agri-business governance and value chains and commercial input delivery systems.

6 Tensions between participation and the commodification of seeds

There is an inherent tension within Ghana's seed development system between participatory plant-breeding networks and the commercial networks of seed certification and distribution. Participatory breeding relies on farmers' own evaluations of new varieties based upon local knowledge and preferences and the incorporation of those varieties into breeding and open access arrangements between breeders and farmers. Through these relations, farmers also gain access to unreleased varieties, which they experiment with and distribute through their own networks. In contrast, commercial networks are concerned with establishing formal markets for certified seeds where farmers usually multiply their own seeds and low demand exists. This leads to policies and practices that represent seeds as technical objects or artefacts in themselves that can be appropriated and commodified, rather than as public goods produced through a dynamic, open process of joint research and co-production of knowledge. It also results in narratives that construct commercial seeds as the panacea to food security problems and depict the main constraint to agriculture innovation as resulting from the lack of penetration of agro-dealers into rural areas to deliver these new seeds to poor farmers.

The stress on the importance of the private sector in agricultural development aligns agricultural policies with the dominant neoliberal concerns in macroeconomic policy and the increasing power of agri-business. This has been embraced by the state since public research and state development agencies find a new lease of life and sources of funding within this agenda and potential commercial profits. On the other hand, this serves to marginalise the important public role that farmers have played in contributing to the development and circulation of new varieties, local varieties and old public genetic materials in agricultural production. At the same time, however, it promotes an imagined role for a commercial seed sector that has yet to be established. The role of the private sector becomes a performative one, facilitating a repertoire of networking activities to create a market that has not existed, as though it is already proven and tested. Many international and national NGOs have embraced this new approach, and act as part of emerging and virtual agri-business networks.

This new architecture to promote market development in the seed system attempts to bridge the public–private sector divide, with actors from the various sectors actively working in various programmes to achieve enhanced production and dissemination of commercial seeds. These developments have sought to encourage a synergistic integration of the activities of various private sector actors and NGOs. They have also tried to encourage farmers to take up a range of inputs to produce a standardised product with a niche market among brand food processors and brewers. In addition, they share the transaction costs of integrating farmers into markets and create institutional structures to ensure that farmers comply with

the discipline of food chain governance, where choice is limited and standards are strictly imposed. Thus, the leaflets distributed by Masara N'Arziki paint a rosy picture of farmers' gains from their integration into the technological treadmill of modernisation, but they also carry the logos of all the various sponsoring companies and the agricultural inputs they sell, in which the farmers' association is transformed into a virtual marketplace.

There are distinct tensions within this process of market promotion and integration. The first relates to the implications of the contradictions between seed development as a dynamic and participatory process of the practice of knowledge for social advancement and seed development as the possession of knowledge for profit, an intellectual property to be commodified and controlled. The second results from the discrepancies between policy visions of farmers happily integrated into seed markets gaining superior yields and incomes, and the reality of low usage of certified commercial seed among farmers and dissatisfaction with many aspects of commercial seed.

In the past, important NGO seed initiatives evolved out of the community seed banks. Before these programmes became wedded to commercial input delivery, many NGOs had attempted to direct community initiatives towards contractual arrangements with food processing firms, where the companies were willing to pay high premium prices for superior and uniform quality grain. The NGOs focused their activities on training farmers to improve their skills in seed multiplication of new improved varieties for planting on their farms. They developed linkages with seed-breeders and agronomists to facilitate the multiplication of high-quality seeds by farmer groups. These initiatives historically preceded the attempts to commercialise seed, and occurred in an era in which multiplication of seeds by farmers with researcher supervision was considered a normal activity. For instance, much of the improved seed initially distributed by the SG 2000 project to farmers, before the privatisation initiatives of the late 1980s, originated from farmer-led multiplication.

The development of farmer participation as a means to adapting and fine-tuning seeds to local farming conditions created considerable free exchange between farmers and researchers, in which researchers would release varieties to farmers for testing and farmers would be involved in the multiplication of these seeds for subsequent on-farm testing on demonstration plots. Many of the seeds disseminated by international agricultural research centres to national crop research institutes needed to be multiplied to create sufficient quantities for on-farm trials. Since the research institutes lacked the logistical capacity to undertake the multiplication of seeds in sufficient quantities, they have worked with supervised farmers' groups to achieve this.

As NGOs involved in community-led seed multiplication programmes became co-opted into new commercial seed networks, they were expected by donors to replace farmer-multiplied seeds with certified seed. Increasingly, however, they have found the certified seed produced by seed-growers to be of variable and unreliable quality. As a result, they have been forced to find alternative sources of seeds, which invariably results in a return to farmer multiplication initiatives. Not only is the quality of certified seed unreliable, but some of the new varieties created by the public research system frequently fail to perform on farms. For instance, NGOs involved in the production of quality sorghum for the brewing industry introduced the improved *Kapala* variety to farmers in northern Ghana. This variety has problems with compact heads, which are susceptible to mould within the wetter districts of the Northern Region. The compact heads are also vulnerable to predation by birds. Farmers found that the performance of this variety in their fields was highly disappointing. The NGOs involved in developing contractual relations between the breweries and farmers are now attempting to find other viable varieties from Nigeria for multiplication within community programmes.

These experiences have generated much acrimony within the commercial seed networks in northern Ghana, with seed-growers accusing seed-breeders of exceeding their mandate and interfering in the production of foundation seed, and participatory seed-breeders accusing seed-growers of producing sub-standard seed. Seed-breeders are themselves divided between those who see seed-breeding as a public service and

those who are interested in its commercial potential. Those with a commercial disposition advocate the introduction of legislation to halt the free appropriation of seeds by farmers and a more pronounced focus on hybrid seeds in public research institutes to prevent farmers freely disseminating OPVs. They see these developments as necessary prerequisites for creating a suitable environment for commercial seed development.

The vast majority of farmers remain unconvinced about the superiority of certified seed and continue to multiply their own stocks of seed, which include both local varieties and modern varieties. In a survey of small-scale farmers conducted for the Future Agricultures Consortium at Kpalung and Dundo in the Northern Region in January 2010, 85 per cent of farmers purchased synthetic fertilisers, but only 6 per cent purchased seed for planting, while another 7 per cent purchased small quantities of seeds, which they then multiplied for planting. At the same time, 85 per cent of the farmers used their own seeds for planting, although their 'own seeds' included a wide assortment of varieties, including current certified varieties, delisted varieties that had been phased out and the latest experimental varieties which had not yet been formally approved but were released to farmers for evaluation in on-farm trials (*cf.* Amanor 2010).

Farmers rapidly distribute new varieties through their social networks. Access to a wide and freely available genetic pool for experimentation becomes an underlying philosophy of small farmer adaptation. Although farmers are frequently disappointed by the quality of certified seed and the performance of many modern varieties, they continue to find varieties that they admire, which become adapted through further farmer selection under local conditions. Consequently, farmers' fields become the repository for the preservation of both the diversity of local species and those that have originated in the public research system, and there is considerable intermixing of varieties. Public research has generated many modern varieties, but many of these are rapidly displaced in the research system as problems emerge with their performance and improvements are rapidly made, only to reveal new sets of problems. The national research system and commercial seed-growers have a low capacity to maintain a wide variety of genetic materials in production. As these varieties become phased out to make way for the latest varieties, they continue to be conserved on farmers' fields and become absorbed into the lexicon of local varieties, where they contribute to the genetic diversity of farmer experimentation and adaptation.

7 Conclusion

Although there have been many problems with the quality of seed produced in the public research system in Ghana, it has, on the whole, made important contributions to the access of farmers to genetic materials. In this respect, it has generated increasing options and strengthened the capacity of farmers to exercise choice. The involvement of farmers in the process of participatory evaluation has also contributed to this choice. However, this choice essentially emanates from a process of incremental plant breeding rather than from the inherent characteristics of particular varieties. Attempts to commercialise seeds and promote farmers' purchase of seeds transform the value of a participatory process of incremental breeding into the value of a specific possessed variety by a commercial entity. Free exchange of genetic resources becomes a violation of this property right, although farmers have freely contributed to some of the characteristics of the variety through participation in on-farm trials, or the free contribution of their own varieties for adaptive breeding. This framework of property rights in commercial seeds devalues the knowledge of farmers and their contributions to the make-up of modern varieties. Conversely, it overestimates the potential of particular commercial varieties to transform agricultural production. It also underestimates the critical importance of maintaining genetic diversity, agro-biodiversity and on-farm conservation of genetic diversity to the maintenance of a sustainable agriculture and future crop-breeding (Altieri 2002).

The mobilisation of influential public–private networks for the promotion and uptake of certified seeds has been achieved through narratives about the superiority of commercial varieties and their potentials to promote pro-poor agricultural growth. These narratives serve to close down more pluralistic and participatory options that previously produced varieties based

on farmers' own learning, knowledge and experimentation in an open access environment, and on the cross-fertilisation of knowledge between public scientists and farmers. However, they do not accurately reflect the shortcomings of many modern varieties and the difficulties of breeding 'miracle seeds' for diverse settings.

The displacement of farmers' varieties by commercial seeds, the creation of legislation and regulations that favour intellectual property rights for varieties developed by commercial breeders, and the erosion of the process through which public research releases new varieties to farmers for evaluation and planting threatens the processes and premises on which plant breeding in complex and risky environments has been based over several decades. The lack of a reflexive and pluralistic seed agenda in Ghana results in a single, hegemonic discourse that locks farmers into narrow agri-business arrangements and input markets. Certified seed thus becomes one element of a monopoly package in which access to the other benefits of agricultural modernisation cannot be acquired without adopting commercial varieties and their ideological baggage. This presents one dominant pathway for agriculture development based on a pre-determined vision of the African Green Revolution, rather than a more deliberative approach to social learning and innovation based on alternative visions of many possible food futures.

Notes

1 For details on these initiatives, see: Millennium Villages Project, www.millenniumvillages.org/; Millennium Challenge Corporation, www.mcc.gov/; Alliance for a Green Revolution in Africa, www.agra-alliance.org (accessed 5 May 2011).

2 For a copy of the IFDC report, see: http://pdf.usaid.gov/pdf_docs/PNACR787.pdf (accessed 29 April 2011). Similar studies were prepared by IFDC for Burundi, Malawi, Nigeria, Rwanda, Uganda, Zambia and other African countries. All shared the same kinds of technical recommendations and policy solutions.

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