Enhancing crop productivity through community-based seed multiplication system

E. A. ASIEDU, A. A. DANKYI, K. O. MARFO, S. S. DENWAR, B. B. SINGH, N. MAROYA & A. G. J. VAN GASTEL

(E. A. A. & A. A. D.: CSIR-Crops Research Institute, P. O. Box 3785, Kumasi, Ghana; K.O. M. & S. S. D.: CSIR-Savanna Agricultural Research Institute, P. O. Box 52, Tamale, Ghana; B. B. S.: International Institute of Tropical Agriculture, P. M. B. 5320, Oyo Road, Ibadan, Nigeria; N. M. & A.G. J.V. G.: GTZ/Seed Project, P. M. B. 9698, KIA, Accra, Ghana)

ABSTRACT

Improved quality seeds out-yield farmers' saved seeds significantly. However, the limited availability of such seeds through the conventional seed supply system is due to socio-economic factors and inadequacy of skilled personnel and infrastructure. A community-based seed multiplication system was, therefore, adopted and small seed stocks of soybean, cowpea and yam were distributed to farmer groups in the rural communities in northern Ghana, northern Nigeria and central Togo, respectively, between 1996 and 1999 for further multiplication. An impact assessment after 4 years showed a significant ease of farmers' access to improved seeds and development of linkages with pesticide dealers, credit sources, and extension services as a result of opting for this system. Quality of farmers' saved seeds had improved and farmers' yield had increased over 90 per cent. Extra incomes earned were used to purchase household items, and part invested in transport businesses and rearing of small ruminants as well as in human capital such as paying children's school fees and family hospital bills and meeting other social responsibilities. This system was, therefore, effective in diffusing improved seeds and associated technologies and services to many more farmers and communities within a very short time to improve their socio-economic status.

Original scientific paper. Received 09 Mar 03; revised 03 Sep 05.

RÉSUMÉ

ASIEDU, A. E., DANKYI, A. A., MARFO, K. O., DENWAR, S. S., SINGH, B. B., MAROYA, N. & VAN GASTEL, A. G. J.: *Amélioration de la productivité des cultures par le système de multiplication de graine basé à la communauté.* Les graines de qualité améliorée dépassaient considérablement en rendement les graines gardées par les agriculteurs. Cependant, la disponibilité de telles graines par le système conventionnel de provision de graine est limitée en raison de facteurs socio-économiques, l'insuffisance de personnel qualifié et l'infrastructure. Un système de multiplication de graine basé à la communauté était donc adopté et une petite quantité de stocks de graine de soja, de dolique et d'igname étaient distribués aux groupes d'agriculteurs dans les communautés rurales dans le nord du Ghana, le nord du Nigéria et le centre du Togo respectivement entre les années 1996 et 1999 pour de multiplication davantage. L'évaluation d'impact entreprise après quatre années montrait une aisance considérable avec laquelle les agriculteurs avaient accès aux graines améliorées et aux liens de développement avec les marchands de pesticide, les lignes de crédit et les services de vulgarisation agricole à la suite d' opter pour ce système. La qualité de graines gardées par les agriculteurs avait amélioré et les rendements d'agriculteurs avaient augmenté plus de 90%. Les suppléments de revenus gagnés étaient dépensés pour les articles ménagers, et une partie du revenun était investie en entreprises de transport et en élévage de petits ruminants ainsi qu'en ressources humaines telles que le paiement de frais de scolarité de la jeunesse, les factures hospitalières et pour régler d'autres responsabilités sociales. Ce système était donc efficace pour la distribution de graines améliorées et la vulgarisation de services et de technologies liées à l'agriculture à beaucoup plus d'agriculteurs et aux communautés dans très peu de temps pour améliorer leur situation socio-économique.

Introduction

Improved quality seeds and planting materials of cereals, legumes, and root and tuber crops may yield three to five times that of farmer's variety under optimum input levels, and two to three times under traditional farmers' management practices (GGDP, 1995; RTIP, 2000). However, the supply of such seeds and planting materials by the formal seed system in West Africa is limited as a result of inadequate human resources, infrastructure, and lack of business and marketing skills of most seed entrepreneurs. This compels farmers to opt for poor quality seeds from informal sources.

The formal seed system derives its strength from mechanisms and resources that ensure uninterrupted supply of good quality seeds and planting materials to farmers. But its major flaw is its inability to deliver the required quantities of seeds and planting materials to the doorsteps of farmers at affordable prices. For example, in Costa Rica, Honduras and Nicaragua, the formal seed sector is able to meet only 2, 13 and 6 per cent of maize seed needs; and 21, 6 and 13 per cent of common bean seed needs, respectively (Almekinders & Louwaars, 1999), which were woefully inadequate. Similarly, in Ghana and Nigeria, only 5 to 10 per cent of total seeds and planting materials of the major cereals and legumes planted annually come from the formal seed sector (Asiedu, 2002; Oresajo, 2002). The situation is worse for other crops and for other countries in West Africa (WASNET, 2002).

Thus, most seeds planted by farmers come from the informal sources. The major drawback of this sector is lack of quality assurance and security in times of emergencies. However, the strength of the informal system stems from its extensive and comprehensive distribution network. The complementarities in the formal and informal systems will, therefore, enhance effective distribution of quality seeds to increase production and incomes of farmers (Almekinders & Louwaars, 1999). A community-based seed production and supply system offers such an option. The system is adapted to a wide range of crops and communities, including marginalized ones.

The objectives of this project were to introduce improved seed and planting material to farming communities which, hitherto, were not reached by the formal seed supply system; and to assess the socio-economic impacts of the system on the beneficiary communities.

Materials and methods

A programme was started in 1995 with financial support from the West Africa Seed Development Unit (WASDU) and United States Agency for International Development (USAID). But technical assistance came from the International Institute of Tropical Agriculture (IITA) and Kano State Agricultural Development Project, both in Nigeria; CSIR-Savanna Agricultural Research Institute (SARI), CSIR-Crops Research Institute, and Ministry of Food and Agriculture (MOFA), all in Ghana; and the National Agricultural Research Institute in Togo.

In Ghana, 5-kg packages of a cream-seeded soybean variety (Salintuya 1) were initially supplied to 30 nucleus farmers (each working with 10 other farmers) in six villages within two districts of the Northern Region. After harvest, 5 kg of seeds were collected from each farmer and redistributed to new farmers in other communities during subsequent years. In Nigeria, 300 g of a preferred white-seeded cowpea variety (IT90K-277-2) were initially distributed to 20 nucleus farmers in the Kano State to multiply two times to produce enough seeds to start the project. From the second harvest, 5 kg were collected from each farmer for redistribution to new farmers during subsequent years. In Togo (Middle Belt), 10 seed yams of a preferred variety, Florido, were initially multiplied by each of selected three-farmer groups, using the rapid multiplication minisett technique, and given to other farmers who multiplied and distributed the material further in subsequent years. The farmers engaged in this scheme were supervised directly by research personnel and extension officers, who also provided technical

services and linkage opportunities to agro-input dealers. Key elements of the community-based multiplication scheme were as follows:

1. Participatory adaptive trial and varietal selection in the target areas to ensure adaptability and acceptability.
2. Farmers' interest in the variety for food preparation and income generation.
3. The community seed and planting material scheme complements the formal seed delivery system rather than competing with it.
4. Progressive farmers with opinion leadership qualities identified as a nucleus.
5. A small quantity (5 kg of soybean, 300 g of cowpea, and 10 seed yams) given to the nucleus farmers and their groups to multiply.
6. Improved methods are used in multiplying the seed or planting material.
7. Part of seed materials produced from the initial multiplication must be continually distributed to other farmers during subsequent years.
8. Provision of supervisory and extension services are vital to its success.
9. Periodic impact assessments to determine socio-economic impact, quality of farmers' saved seeds and planting material, and strategize the future.

Random samples of communities participating in the project were taken from Ghana, Togo and Nigeria and interviewed, using questionnaires. Collaborating scientists and extension officers in the respective countries provided the list of farmer groups involved in the programme. From the list, communities which participated in 1999 and 2000 were 20 in Ghana for soybean, 24 in Togo for yam, and 50 in Nigeria for cowpea. Random samples of 12 communities each from Ghana and Nigeria, and eight from Togo were interviewed. Each community comprised an average of 10 farmers.

Results and discussion

In northern Ghana, 58 per cent of farmers who acquired seeds from the community seed producers were classified as poor, and the remaining 42 per cent were classified between poor and rich. Most farmers interviewed were subsistence farmers who produced mainly to feed the household family; soybean was used to prepare a food flavour locally known as *dawadawa*. In combination with sorghum, soybean was used to prepare a main dish, *tumbani*, which, according to a farmer, was so filling and compelled the children to rest in the house rather than wonder about. In Togo, 13 per cent of farmers who acquired seeds were poor, 74.0 per cent were between rich and poor, and 13 per cent rich. In northern Nigeria, 17 per cent were poor, 33 per cent were between poor and rich, and 50 per cent were rich.

The number of farmers who purchased improved seeds from the community-based seed multiplication system in Ghana increased from 187 (in 1998) to 394 (in 1999). In Nigeria, an increase from 1337 to 1922 was observed within the same period. However, seed purchases declined to 1485 in 2000 because most farmers had already acquired cowpea seeds. Unlike Ghana and Nigeria, which started the scheme early (1995-1996), Togo started late (1998); however, in 1999, just after 1 year of participation, yam seeds were sold to 132 yam farmers.

Farmers who acquired soybean seeds free from the community seed producers in Ghana also increased from 59 (in 1998) to 439 (in 1999), and thereafter declined to 10 in 2000 for a reason explained earlier. In Nigeria, the numbers supplied with free cowpea seeds were 173, 220 and 182 in 1998, 1999 and 2000, respectively. In Togo, farmers who received yam planting materials free of charge were 25 and 8 in 1999 and 2000, respectively. On the average, each farmer participating in the project sold soybean seeds to 24 other farmers in Ghana per year. In Togo, yam seeds were sold to 15 other farmers; and in Nigeria, cowpea seeds were sold to 132 other farmers. In addition, 14 other farmers in Ghana, 1 in Togo, and 16 in Nigeria received improved seeds and

planting materials free from each of the community-based seed producers. Farmers who were supplied with seed from this system observed 90 per cent increase in crop yield in Ghana and 94 per cent in Nigeria. The saturation of the communities with improved seeds within 4 years clearly shows the efficiency in the community-based seed multiplication system.

Increased productivity was observed in the farmers participating in the system and farmers who acquired seeds from it. Their skills in managing the field had also improved.

The average area under cultivation of soybean had increased significantly in Ghana from 0.8 to about 1.1 ha per farmer; but in Togo and Nigeria, the areas had not increased significantly. Sixty-four percent of farmers in Ghana, 75 per cent in Togo, and 100 per cent in Nigeria indicated increases in the quantity of their produce. Between 73 and 100 per cent of farmers had their incomes increased from sales of their produce.

The high adoption rate observed within the first 4 years of the project was the result of introducing preferred crop varieties and of research personnel and extension officers supervising effectively. These observations were in line with similar ones made in Kenya in introducing pigeon pea to farmers (Muli , Omanga & Jones, 1997). The germination or sprouting percentages of seeds and planting materials produced by farmers were 97 for soybean in Ghana, 89 for Yam in Togo, and 94 for cowpea in Nigeria. The certified national minimum germination standard for marketing soybean and cowpea seeds in Ghana is 75 per cent (Ocran *et al.*, 1998). For high germination percentages, seeds must be planted for harvest toward the dry season, dried to 8 per cent moisture content or below, and packaged in moisture-proofed bags for storage. Thus, the high percentages observed were due to adopting improved cultural and seed storage practices and effective technical supervision. No standard exits now for yam.

Limitations and lessons

In Ghana, soybean and cowpea were introduced to the farmers at the same time; but farmers opted for soybean and abandoned cowpea because of the low production cost of soybean, which enticed them to adopt the crop. The use of soybean in the local preparations further enhanced its adoption. These farmers used part of their extra income to purchase household needs and part was invested in animal production (Table 1). These benefits were more vivid in Nigeria where farmers had high incomes from the vibrant commercial activities in Kano State, which is an international grain market in West Africa. The remaining part of the income was used to invest in human capital, such as paying children's school fees and hospital bills, and meeting other social obligations (Table 2).

On linkages, the farmers

TABLE 1

Use of Extra Income Derived from Sale of Soybean, Yam or Cowpea Produced Through the Community-based Seed and Planting Material System in Ghana, Togo and Nigeria

	Farmers' extra income usage		
Item	*Ghana (% farmers)**	*Togo (% farmers)**	*Nigeria (% farmers)**
Goat/Sheep/Cow	46	25	100
Mattress	10	5	48
Bicycle	9	5	50
Furniture	0	0	48
Sound system	0	0	50
Poultry	0	0	50
Motor-cycle	0	0	25
Vehicle	0	0	8
Built house	10	5	25
Television set	0	0	17

*An individual in a sample had multiple use of his extra income, and percentage of each use is independent of the others

TABLE 2

Human Capital Investments Derived from Selling Soybean, Yam or Cowpea

Item	*Farmers' human capital investment*		
	*Ghana (% farmers)**	*Togo (% farmers)**	*Nigeria (% farmers)**
Pay school fees	83	25	58
Family livelihood	82	25	100
Hospital bills	64	13	50
Marriage	18	0	58
Burials	30	0	50
Other social activities	46	0	83
Pilgrimage to Mecca	0	0	8

*An individual in a sample had multiple use of his extra income, and percentage of each use is independent of the others

agreed that the system had helped them to readily get access to improved seed, facilitated credit acquisition, and had taught them where to obtain the right agro-inputs (Table 3). It had also enhanced their interaction with agricultural extension officers and had helped them expand their farms, resulting in significant increases in incomes generated. In Ghana the scheme started in one region in 1995 and, by 1999, had covered three regions in the northern Savanna zones; with corresponding increases in number of districts, villages and farmers, and quantities of seed produced (Tables 4 and 5). The inability of some farmers to expand their fields was attributed to lack of land-tilling machinery. The extension of the no-till technology for land preparation and weed control will, therefore, help to expand farm areas besides intensifying production.

In Nigeria, the commercial value of the new

TABLE 3

Usefulness of Community-based Seed and Planting Material System to Farmers

Practice	*Farmers' access to inputs and services*		
	*Ghana (% farmers)**	*Togo (% farmers)**	*Nigeria (% farmers)**
Have easy access to improved varieties	100	100	83
Save time in purchasing seeds	100	100	75
Select good seeds	100	83	75
Where to get seeds	92	75	75
Type of improved seeds	73	100	83
Receive extension advice	92	88	92
Improve interaction with farmers	100	75	83
Provide cheaper seeds	100	100	92
Type of pre-flowering insecticides	NA	NA	92
Type of post-flowering insecticides	NA	NA	92
Helped to expand farm	55	40	75
Facilitated credit acquisition	18	33	0
Increased credit worthiness	64	71	33
Obtain extra income	82	88	100

*An individual in a sample had multiple use of his extra income, and percentage of each use is independent of the others
NA = Not available

TABLE 4

Achievements of the Community-based Seed and Planting Material System in Northern Ghana Since 1995

Year	*Geographical location and multiplier*			
	Region	*District*	*Village*	*Number of multipliers*
1995	1	2	6	30
1996	1	3	19	90
1997	3	12	47	235
1998	3	12	65	325
1999	3	15	102	NA
2000	3	NA	NA	540

NA = Not available

TABLE 5

Diffusion of Soybean Seeds Produced by Community-based Seed and Planting Material System in Ghana

Year	*Quantity of seeds (kg)*	*Estimated area under cultivation (ha)*
1995	593	24
1996	2970	119
1997	6085	243
1998	5399	216
1999	9431	377

white-seeded cowpea variety stimulated the extensive adoption. Farmers' main concern was the high cost of insecticides, although they recognized that it was imperative to use insecticides for improved cowpea cultivation. Another complaint was that chemicals were adulterated by unscrupulous chemical dealers, making spraying ineffective sometimes. This problem, which may be prohibiting the rapid growth of the cowpea market in Kano State, needs to be addressed. One of the problems generally observed in the fields visited was weeds and time constraint for farmers.

The main focus of extension services in Togo seemed to be on cash crops, with less attention on food crops. The follow-ups to the initial introduction of the yam technologies were not enough. This was compounded by the fact that research workers were not directly involved in transferring technologies to farmers. Technologies are transferred to farmers only through poorly motivated extension service. Despite these problems, most multipliers involved had understood the techniques for multiplying yam seed, and some had adapted the minisett technique to other yam varieties.

Conclusion

The community-based scheme for multiplying seed and planting materials has been one of the most efficient ways of making improved seeds and planting materials, along with associated technologies and services, available to farmers within the shortest possible time. It has had positive socio-economic impacts on farmers' livelihoods and its continuity is highly recommended.

REFERENCES

Asiedu, E. A. (2002) *An assessment of fertilizer and seed sector in Ghana: Policy reforms to enhance trade of agricultural inputs in West Africa*. The African Trade and Investment Programme. USDA, IFDC, AFSTA . 33 pp.

Almekinders, C. & **Louwaars, N.** (1999) Improving local seed systems. In *Farmers' seed production: New approaches and practices* (ed. C. Almekinders and N. Louwaars), pp. 33-58. Intermediate Technology Publications, London.

GGDP (1995) *Annual Report*. Ghana Grains Development Project, Crops Research Institute,

Kumasi, Ghana. 136 pp.

Muli, J. M., Omanga, P. A. & **Jones, R. B.** (1997) Farmer-to-farmer seed supply: A case study of pigeon pea seed distribution in Kenya. In *Alternative strategies for smallholder seed supply* (ed. D. D. Rohrbach, Z. Bishaw and A. J. G. van Gastel), pp. 188-191. ICRISAT, India.

Ocran, V. K., Delimini, L. L., Asuboah, R. A. & **Asiedu, E. A.** (1998) *Seed management manual for Ghana*. DFID Publication, United Kingdom. 60 pp.

Oresajo, F. A. (2002) *An Assessment of fertilizer and seed sector in Nigeria: Policy reforms to enhance trade of agricultural inputs in West Africa*. The African Trade and Investment Programme. USDA, IFDC, AFSTA. 37 pp.

RTIP (2000) *Strategies for planting material multiplication and distribution for cassava.* Minutes of a Mini-Workshop to Develop Strategies for Enhanced Multiplication of Cassava Planting Material. Root and Tuber Improvement Programme, CSIR-Crops Research Institute, Kumasi, Ghana. 9 pp.

WASNET (2002) *Proceedings of the First General Assembly of the West Africa Seed and Planting Material Network* held in Banjul, The Gambia, 22nd-24th January 2002. 178 pp.