Assessing Diffusion of Modern Groundnut Varieties in Mali

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Over the last three decades, groundnut (*Arachis hypogaea*) production in Mali has been relatively stagnant. Its importance as food and cash crop for rural households and supplier of foreign exchange earnings has declined. Groundnut yields have remained relatively low, about 962 kg ha^{-1} below the world average of 1,400 kg ha^{-1} (Ndjeunga et al. 2002). In the processing sub-sector, oil processing has almost stopped. Prospects for regaining production and market shares of Malian groundnut lie in the adoption of improved varieties and crop management technologies that will significantly increase productivity, production and the quality of produce as well as the development of the groundnut processing sectors.

Since the 1980s, ICRISAT, Bamako, Mali and the Institut d'Economie Rurale (IER) have been working in Kolokani, one of the largest groundnut-producing areas in the region of Koulikoro in Mali. Kolokani has a history of experiencing repeated droughts one year out of three. Groundnut is the main source of rural livelihoods representing 37% of the total cultivated area. It is mostly planted as sole crop and in rotation with cereals. Only about 8% of groundnut area is cultivated in association with pearl millet (*Pennisetum glaucum*). Groundnut is cultivated on collective plots by all household members or individual plots owned by either men or women in the household. This study assesses the diffusion and preferences of farmers for varieties tested on farms in the region of Kolokani in Mali.

The Dissemination Process: On-farm Trials

On-farm evaluation was the major tool used in the dissemination process. Since 1998, ICRISAT initiated a series of on-farm trials in Kolokani. Until 2001, a total of 15 groundnut varieties were tested on farms by 169 farmers. These trials were of two types: trials designed by researchers but managed by farmers; and trials designed and managed by farmers. In the latter type, farmers who had participated in open field days at ICRISAT station chose the most preferred varieties to be tested. In general, farmers could choose up to 6 varieties. The distribution of farmers by year and the set of selected varieties are presented in Table 1. The distribution of farmers varied from year to year and/or according to the set of varieties tested. This has significant implications on the assessment of farmers' preference for varieties.

Nine modern groundnut varieties were tested: ICG 7878, ICG (FDRS) 4, ICG (FDRS) 10, Mossitiga, Demba Niouma (ICGS (E) 34), ICGV 92093, ICGV 92088, ICGV 92082 and ICGV 91225. Their major characteristics are resistance to foliar diseases, early- to medium-maturity,

Table 1. Set of modern groundnut varieties tested and distribution of farmers in Kolokani, Mali.

	No. of farmers					
Set of varieties tested	1997	1998	1999	2000	2001	Total
ICG (FGRS) 4			5	10		15
ICG (FDRS) 4, ICG (FDRS) 10, Mossitiga				3		3
ICG (FDRS) 4, ICG (FDRS) 10, Mossitiga, Demba Niouma		21				21
ICG 7878	1			2		3
ICG 7878, ICG (FDRS) 4, Mossitiga					34	34
ICG 7878, ICG (FDRS) 4, ICG (FDRS) 10, Mossitiga, Demba Niouma			20			20
ICG 7878, ICG (FDRS) 4, Mossitiga			1	2	1	4
ICG 7878, ICGV 92088				1		1
ICG 7878, ICGV 92093, ICGV 92082, ICGV 92088, ICGV 91225, Mossitiga				20		20
ICG 7878, ICGV 92093, ICGV 92088, Mossitiga					19	19
ICGV 92082, ICGV 91225				1		1
ICGV 92093, ICGV 92088, ICGV 92082, ICGV 91225		2	20			22
Total	1	23	46	39	54	163

and medium size pods and grains. The yield of all these varieties in farmers' fields was more than 1 ton ha^{-1} pods and 2 t ha^{-1} fodder.

Selected farmers were given 1 kg seed of each of the selected varieties. This quantity was sufficient to plant a plot of 10 m × 10 m along with the traditional variety. Field monitoring and evaluation were conducted by ICRISAT and IER scientists, and a range of development partners including non-governmental organizations (NGOs) such as WINROCK International and ADAF GALLE, rural development projects such as the Office de la Haute Vallee du Niger (OHVN) and la Companie Malienne du Developpement Textiles (CMDT). Every year data on yields and farmers' rapid assessment of their preferences were collected.

In 2000, ICRISAT initiated a small-scale seed production scheme with 4 farmers in 4 villages: Bambabougou, Kanekebougou, Tioribougou and Komokorobougou. These farmers produced about 3.6 t seed of ICG 7878, Mossitiga and Demba Niouma. Only 10% of the seed produced was sold to other farmers, ie, about 348 kg of which 65% was ICG 7878. A survey conducted from May to June 2003 assessed the use of improved groundnut varieties in the villages where seed production was undertaken.

Methodology and Data Collection

The survey involved 16 of the 43 villages that had participated in on-farm trials from 1998 to 2001. Villages were selected along the North-South transect and road accessibility. In each village, on-farm trial participants, who had completed at least one full season, were chosen. Non-participant farmers were selected among the groundnut producers. A total of 245 farmers were interviewed including 99 trial participants and 146 non-trial participants. About 60% of the trial participants were interviewed.

Questions focused on the household socio-demographic and economic profile, resource endowments with land and agricultural equipment in particular, and farmers' preferences for groundnut varieties. In addition, information on use of inputs at plot levels and household livelihood sources, especially cash sources, was gathered.

The socioeconomic profile (age, gender, education and family size) of farmers, institutional and infrastructural environment (access and availability of seed of preferred varieties and access to markets) under which farmers operate, and technological constraints [plant type, crop duration, seed size and color, utilization (oil, edible, confectionery and fodder for livestock) and resistance to foliar diseases] were hypothesized to be the main constraints to adoption and factors explaining farmers' preferences for modern or improved groundnut varieties. The number of farmers using groundnut varieties and area planted to improved varieties are the two simple indicators for adoption.

Results and Discussion

Resource endowments. About 92% of trial participants were male farmers. The average groundnut cropped area was estimated as 2.11 ha with significant differences between trial and non-trial participants. Trial participants planted on average 2.85 ha of groundnut against 1.62 ha for non-trial participants. The trial participants were selected by ICRISAT and based on farmers' experience of groundnut cultivation.

About 81% of groundnut plots were collective plots and the remaining were individual plots. Among individual plots, 50% of the plots were owned and managed by women. The belief that groundnut is a woman's crop is not very clear. More and more men are growing these crops especially in environments where there is no alternative cash crop such as cotton (*Gossypium* sp). Most households are poorly equipped. Most of the agricultural operations are done by hand tools. This low level of usage of farm equipment has significant implications on the potential for expanding groundnut cultivation in the region. Groundnut is highly labor intensive; thus there is a high probability that the returns to labor for groundnut production would be lower than the opportunity cost of labor. In this case the returns to investment in small-scale mechanization in the form of simple animal traction may be high. Household access to equipment is essential to improve productivity.

Inorganic fertilizers are seldom used for groundnut cultivation. About 2.4% of surveyed farmers use fertilizers and 14.1% use organic manure on groundnut plots. However, more farmers treat their seed; about 31% reported treating groundnut seed before planting. No significant differences were found between trial and non-trial participants. Less than 10% of trial participants have exchanged seed with other farmers. This was explained by the need for farmers to build their seed stocks. The initial seed capital given to farmers was very low (1 kg). To build seed stocks equivalent to plant one ha of groundnut, farmers need to plant the initial capital for at least 3 consecutive years assuming that they do not consume or sell any portion of the seed.

All farmers reported the lack of credit as the main constraint to expanding groundnut production. Access to

Table 2. Ranking of the four most preferred modern groundnut varieties by traits against the local check[1].

Trait	ICG (FDRS) 4	ICG 7878	ICGV 92088	Mossitiga	Local check
High fodder yield	2	1	3	4	4
High pod yield	3	4	5	1	2
Large seed size	2	1	3	4	4
Early maturity	3	5	4	1	2
Taste	2	1	5	3	3
Marketability	3	5	3	1	2
Drought tolerance	3	5	4	1	2
Overall ranking	2	4	5	1	3

1. Ranking is scored on 1 to 5 scale, where 1 = the best; and 5 = the poorest.

credit will increase farmers' access to other inputs such as seed, fertilizers and fungicides. This is consistent with findings from Niger (Baidu-Forson et al. 1997).

Preferences for varieties. A simple mean ranking was used to assess farmers' preference for varieties. Of the nine varieties tested, farmers preferred Mossitiga, ICG (FDRS) 4, local variety, ICG 7878 and ICG 92088 by order of decreasing importance. There were no differences in ranking between trial and non-trial participants. The most preferred traits were the high pod and fodder yields, large seed size, taste and drought tolerance (Table 2). In particular, the variety Mossitiga was well rated because of its high drought tolerance, early maturity and high yield compared to the local variety. Similarly, ICG (FDRS) 4 was preferred for the same reasons at a lesser degree. Farmers ranked ICG 7878 as first for high fodder yield, good taste and large seed size. However, many farmers reported that it was not early maturing and drought tolerant. Specifically, farmers reported that during bad years, ICG 7878 performed poorly but produced excellent yields in good years.

Adoption of modern groundnut varieties. Overall, about 51% of trial participants continued to plant improved varieties after 2001. Specifically, 23.2% of farmers continue to plant Mossitiga, 21% ICG 7878, 22.2% ICG (FDRS) 4 and about 8.1% ICGV 92088.

In terms of area planted, on average 32% of the groundnut area is planted with improved varieties. However, the proportion of area planted by trial participants is significantly higher than non-trial participants. On average, trial participants are planting more than half the groundnut cropped area to improved varieties as against 7% area by non-trial participants. This is mainly due to poor access to improved varieties by non-trial participants and little farmer-to-farmer exchange of seed.

There is a strong linkage between the presence of seed producing association and the use of modern varieties. In villages where there are seed producers, farmers are likely to have better access to seed of modern varieties than otherwise. These results are consistent with many other studies which support that adoption of modern varieties and technologies is high in environment where farmers have access to improved seed (Ndjeunga et al. 2003).

Conclusions

This study shows that the diffusion of modern groundnut varieties in the region of Kolokani is relatively high. Through farmer-to-farmer diffusion about 32% of groundnut area is planted with improved varieties in the Kolokani region. Several constraints are limiting the diffusion of modern groundnut varieties. Farmers have little access to seed and other essential inputs to increase productivity as well as to information on varieties. Technical, institutional and market solutions to improve access and availability of households to basic inputs should be vigorously pursued.

References

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