

## **A COST-BENEFIT ANALYSIS OF FARMER BASED SEED PRODUCTION FOR COMMON BEAN IN KENYA**

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### **ABSTRACT**

Community based informal seed production has recently gained popularity as an alternative to the formal seed sector of disseminating new crop varieties including the common bean. This is because farmer produced seed is readily available and is more affordable by most farmers than certified seed. This study examined the profitability of farmer based common bean seed production in Kenya. The study used data collected from farmers and one seed company participating in seed multiplication. The principal finding was that farmer based common bean seed production was a profitable enterprise and was less sensitive to price fluctuations. Compared to certified common bean seed production, net profit margins were five times higher for certified common bean seed than for farmer based common bean seed production. With the current varieties, profitability depends on access to irrigation and good agronomy.

*Key Words:* Certified seed, price fluctuation, profitability

### **RÉSUMÉ**

Une production formelle de semences communautaires a récemment gagné la popularité comme une alternative au secteur formel de semence de dissémination de nouvelles variétés des cultures dont le haricot commun. Ceci se justifie par le fait que la semence produite par les fermiers est disponible et est plus abordable par la plupart de fermiers que la semence certifiée. Cette étude a examiné la rentabilité de la production de semence par les fermiers au Kenya. Les données utilisées étaient celles collectées chez les fermiers et dans une compagnie de multiplication de semence. Le principal résultat était que la production communautaire de semence de haricot commun était une entreprise profitable et était moins sensible aux fluctuations des prix. En comparaison à la production certifiée de semence de haricot commun, les profits nets marginaux étaient cinq fois plus élevés pour la semence du haricot commun certifiée que pour la production de même semence par les fermiers. Avec de variétés actuelles, la rentabilité dépend de l'accès à l'irrigation et une bonne agronomie.

*Mots Clés:* Semence certifiée, fluctuations des prix, rentabilité

### **INTRODUCTION**

Seed is one of the important crop production inputs. In many Sub-Saharan Africa countries, producing enough common bean seed, especially of new varieties remains a big challenge. This has been associated with the failure of the

formal seed sector to multiply sufficient quantities of the new varieties and make it available to the farming communities (Rubyogo *et al.*, 2010). The private sector tends to concentrate on producing seeds of hybrid varieties that are difficult to keep from harvest by farmers, while seed of self pollinated crops like legumes is considered less

profitable (David and Sperling 1999; Rubyogo *et al.*, 2010). Moreover, government institutions lack capacity to produce seed in sufficient quantities.

The role of the informal sector in seed production and distribution is widely recognised (Ndjeunga *et al.*, 2000; Sperling and Cooper 2003; Aw-Hassana *et al.*, 2008). The informal sector distributes seed through many ways that range from seed-to-seed exchange, gifts, form of payment for labour or seed for cash sale. Recent literature indicates that farmer-to-farmer seed marketing has gained importance as a means of seed exchange in Sub-Saharan Africa as economies develop and farmers are increasingly using markets to meet their seed needs (David and Sperling, 1999; Aw-Hassana *et al.*, 2008; Sperling and McGuire, 2010). Sperling and McGuire (2010) found that farmers in Ethiopia proactively used local markets for accessing new varieties. Aw-Hassana *et al.* (2008) in Syria concluded that the informal seed markets are important, but they have received less attention resulting in less resources allocated to their development.

Although community based seed production and dissemination is being promoted as a means of accelerating the diffusion of new varieties for the self pollinated crops like common beans (Rubyogo *et al.*, 2007; Rubyogo *et al.*, 2010, no study has evaluated the profitability of farmer based common bean seed production as a commercial enterprise. The effectiveness of farmer based seed production in bulking and distributing of new common bean varieties will depend on the economic profitability of common bean seed production to the farmer. A study was conducted to assess the costs and benefits to farmers from specialised common bean seed production in Kenya.

## MATERIALS AND METHODS

The study was conducted in Nyanza and western parts of Kenya. Overall, three districts of Hombay, Nakuru and Busia; categorised by FAO (1996) as medium potential agricultural zones, were selected since the farmer based seed production enterprises were relatively well spread.

A purposive sampling procedure was adopted since the number of seed producers for new bean

varieties was still low and scattered in each district. Data were obtained from a total of 30 farmers who produced improved bean seed.

A pretested questionnaire was used to elicit information on costs and benefits through face to face interviews with seed producers. Detailed information was collected on all the variable production costs incurred from land preparation to harvesting and post-harvest handling, as well as materials used in seed production. Efforts were made to value purchased and non-purchased inputs, such as family labour. Each respondent was asked to estimate the cost of labour he/she would be willing to pay to accomplish the task if he/she was to hire labour. Market prices for seed selling and yield were also collected. Since most of the fertilisers were organic farm yard manure with no market value, most of the costs were associated with labour for collection, transporting and application rather than actual purchase of the fertiliser. These data were used in the calculation of the net margins or profit (defined as the residual after variable production costs are deducted from the total revenue from seed production activities ([www.investopedia.com/term/profit](http://www.investopedia.com/term/profit))). Most of the marketing took place at farm gate and, hence, costs of marketing were minimal and not included. Although the net margins may include returns that may be attributed to less tangible factors of seed production and delivery such as managerial inputs, partner search, enforcement and information gathering, costs of such inputs were not explicitly included in the set of relevant costs because of the difficulty in quantification and valuation.

Farmers were also asked to classify the utilisation of the harvest into seed and grain, and the price at which a unit of each was sold. For grain that was consumed at home, a market price during the time the grain was consumed was used and also applied to the grain consumed and grain given out in form of gifts. The concept of willingness to pay was used to value all products and inputs (family labour, farm yard manure) that had no market prices. This concept has been used in other studies to value inputs and technologies for which market prices were non-existence or were subject to imperfect measurement (Horna *et al.*, 2005). One seed company involved in the

production of certified common bean seed was also interviewed on costs and benefits accruing to certified bean seed production. All costs and benefits were standardised to hectare level.

The net margins were used for the analysis. Percentages were used to analyse the share (computed as a percentage of the total variable costs) of each cost item in the total variable costs. Land was assumed as a fixed cost and was excluded from the analysis. Computation for net margins involved budgetary analysis specified as:

$$AGM = ATR - AVC$$

Where AGM is the average gross margin, ATR the average total revenue; and AVC the average variable cost. Gross output in bean production constitutes those products which become available after harvest as seed and grain.

Data were pooled and analysed as one sample because the number of observations (30 producers) could not support analysis of disaggregated data, but this limited our ability to assess the impact of management and other factors on profitability.

A sensitivity analysis using the estimated economic values (costs and benefits) was

undertaken to incorporate uncertainty into economic evaluation. To assess the stability of profitability of seed production, the price of seed and the quantity utilised as seed were reduced by 10 and 20%; and new gross margins computed. Another scenario for simulation was done for yield to assess the likely impact of a varietal improvement on the profitability of seed production by farmers.

## RESULTS AND DISCUSSION

### Costs of farmer based bean seed production.

Table 1 shows the expenditure on materials and operations incurred by farmers in the production of bean seed. The average variable cost of producing bean seed was US\$ 388 per hectare. This is relatively higher compared to the national estimates of US\$ 121 in 2004 for common bean grain production (Spilsbury *et al.*, 2004). This is both due to increases in labour costs as time passes, which was already high in Kenya by 2004 (Spilsbury *et al.*, 2004), and also due to increases in physical quantity of labour used when the primary output is seed to ensure good quality. Among the components of the total variable costs, expenditure on labour for ploughing, planting, weeding, harvesting, roughing, plant

TABLE 1. Estimated variable costs (US\$) of farmer produced common bean seed in Nyanza and western parts of Kenya

Variable cost	% of producers incurring the cost	Mean (US\$)	Std.Dev (US\$)	% of total cost
Costs of materials		90	69	22
Seed	100	51	33	12
Bags	90	4	4	1
Seed treatment	70	8	9	2
Fertiliser (manure)	70	57	56	14
Cost of operations		298	122	72
Ploughing	100	81	51	20
Planting	100	36	18	9
Weeding	100	78	54	19
Roughing	20	6	15	2
Plant protection	30	2	5	1
Harvesting	100	30	18	7
Post harvest handling	100	34	34	8
Total variable cost	100	388	141	100

NB: TVC = cost of materials + cost of operations

protection, harvesting and post harvest handling formed the largest cost item and accounted for 72% of the total variable costs (Table 1).

Ploughing and weeding were the major operational activities contributing to the labour cost for bean seed production (Table 1). Seed and organic fertilisers were the major inputs on which material expenditure was substantial. Costs on items such as use of chemicals in seed treatment before storage, rouging and plant protection accounted for a smaller share (about 5%) of the variable costs because most of the producers did not apply the practices. Low use rates of the chemicals to treat common bean seed before storage has been observed in previous farmer seed production in western parts of Kenya (Opole *et al.*, 2003). This is an indication that farmers tend to produce common bean seed using their traditional methods to minimise costs. The traditional method of broad casting seed rather than following the recommended row planting was also mainly used, but its overall effect on the total costs was unclear. The common feeling among the common bean producers in the parts of eastern Africa is that row planting is labour intensive, but David (1998) asserts that it saves

labour during weeding and perhaps harvesting. Lack of data on row planting constrained the analysis of the potential saving on costs associated with the technique.

Compared to one seed company, per hectare cost of farmer based common bean seed production was US\$ 328 lower than the cost of producing certified bean seed (Table 2). This result was consistent with previous reports that farmer based seed is cheaper than certified seed (Moyo *et al.*, 2004; Rubyogo *et al.*, 2010). Results also show high variability in the variable costs of common bean seed production incurred by farmers (Table 3). The high variability in production costs reflects the differences in the management levels, with the producers who implemented all the recommended practices incurring higher costs.

#### **Revenue from farmer bean seed enterprise.**

Revenue from bean seed production was computed as the total value of seed, grain and leaves. A mean value of US\$ 606 per hectare was realised from common bean seed production by farmers (Table 3). The revenue per hectare was

TABLE 2. Per hectare costs of certified seed production compared with farmer produced seed

Items of cost	Certified seed (formal sector)	Farmer based seed (informal sector)
	US\$	US\$
Cost of materials	175.4	89.8
Seed	63.4	51.0
Fertiliser	99.0	56.6
Chemical for plant protection	8.8	2.4
Chemical for seed treatment	3.3	8.2
Bags	1.0	3.5
Operational costs	540.3	297.8
Irrigation	23.9	
Ploughing	138.6	81.5
Plant	19.8	36.2
Weeding	39.6	77.9
Rough	0.5	6.4
Field inspection	11.9	
Harvesting	15.6	29.8
Post harvest handling	9.9	34.2
Processing	244.2	
Storage	36.3	
Total variable production costs	715.7	387.6

highly variable among producers, ranging from US\$ 58 to 1727 (Table 4).

Over 80% of the harvest was sold as seed at a mean price of about US\$1.3. A higher price of seed relative to the price of grain motivated farmers to sell a bigger proportion of the harvest as seed, which contributed to the higher gross revenue (Table 5). On the other hand, average yield was modest as it amounted to 526 kg per hectare though some farmers obtained as high as 1330 kg ha<sup>-1</sup> (Table 5). Low yield obtained by some farmers was attributed to low levels of input used and rainfall failure. Compared to the certified seed, the bean seed from farmers was availed at a fair price, but the gap between the price of certified

bean seed and farmers seed seemed to narrow when institutions bought farm produced seed, highlighting the importance of partnership building in informal seed multiplication.

**Profitability of farmer based bean seed production.** Net revenue computed as total revenue minus total variable costs is presented in Table 3. An average of US\$ 219, constituting 36% of the total revenue was earned as net revenue per hectare. This result indicates that farmer based seed production is a profitable enterprise, which is consistent with findings from the study conducted by Chivatsi *et al.* (2002) on the community based seed production of the open pollinated maize in western Kenya.

However, the study results indicate that the average profits from the farmer based common bean seed production were much lower than the profits earned from the certified seed production by seed companies (Table 5). The big difference in profits was due to two major factors; namely, high productivity originating from use of irrigation and relative high price for certified bean seed. This is expected given that profit is a function of

TABLE 3. Costs and returns from farmer based common bean seed production in Nyanza and western Kenya

	Mean value (US\$)
Total revenue	606
TVC	388
Net revue (profits)	219
Profit margins (%)	36

TABLE 4. Common bean seed harvested (kg ha<sup>-1</sup>), average unit price and revenue in Nyanza and western Kenya

Variable	Mean	Std. Dev.	Minimum	Maximum
Total harvest (kg)	526	419	49	1330
Quantity of bean seed (kg)	458	393	33	1216
Quantity of bean grain (kg)	68	63	0	185
Per kg price of bean seed (US\$)	1.3	0.3	0.8	1.6
Per kg price of bean grain (US\$)	1.0	0.3	0.5	1.33
Total revenue from bean seed (US\$)	533.3	588.5	0	1621.3
Total revenue from bean grain (US\$)	72.1	79.1	0	247.1
Value of bean leaves	0.7	2.1	0	6.6
Total revenue	606.1	579.5	58.2	1727.7

TABLE 5. Comparisons of the revenue and gross margins of certified bean seed and farmer produced seed enterprises

	Mean values (US\$)	Mean values (US\$)
Quantity harvested (kg ha <sup>-1</sup> )		
Unit price of seed	1.9	1.3
Per kg price of bean grain		1.0
Total revenue	1848.2	606.1
total variable costs	715.2	387.6
Net revenue (profits)	1132.5	218.5

TABLE 6. Sensitivity analysis of the profitability of farmer based common bean seed production in Nyanza and western Kenya

Item description	Original	10% reduction in price	20% reduction in price	10% increase in yield	30% increase in yield
Total harvest (kg)	526	526	526	579	684
Quantity of seed sold (kg)	458	458	458	503	595
Quantity of grain (kg)	57	57	57	58	75
Quantity of seed given in Gifts (kg)	11	11	11	12	14
Unit price of seed (US\$)	1.3	1.2	1.0	1.3	1.3
Unit price of grain (US\$)	1.0	1.0	1.0	1.0	1.0
Total revenue from seed (US\$)	533.3	525.4	485.5	640.9	757.5
Total revenue from grain (US\$)	61.1	61.1	61.1	55.5	72.1
Value of seed given in gifts (US\$)	11.0	10.0	10.0	11.1	13.1
Value of leaves (US\$)	0.7	0.7	0.7	0.7	0.7
Value of haulm (US\$)	0.4	0.4	0.4	0.4	0.4
Total revenue (US\$)	606.1	596.2	556.5	708.5	843.7
Profit (US\$)	190.5	180.6	140.9	292.9	428.1
Profit as % of total revenue	31	30	25	41	51

price and yield and a change in any of the two could influence the crop profitability (Chengappa *et al.*, 2003).

**Sensitivity analysis.** Table 6 shows that farmer based seed production enterprises were likely to be more sensitive to yield than to price fluctuations. A reduction in price of seed by 10% reduced the profitability by about 1%, while a similar increase in yield increased profitability by 10%. A further reduction in prices by 20% to equate seed price with grain price reduced the profitability by 6%, implying that a huge change in price will be required to significantly alter the profitability of farmer based common bean seed production; while a slight change in yield can have a significant impact on the enterprise profitability. A simulation with 30% yield increase over the varieties used here shows that farmers are likely to get 50% of their revenue as profits. This means that with the yield advantage of 35% for the improved varieties in the pipeline (Dr. Stephen Beebe<sup>1</sup>, Per. Comm in 2010), the impact on farmer based common bean seed production and diffusion of new varieties will be higher.

### CONCLUSION

The study suggests that producing common bean seed by farmers in the informal sector is a

profitable enterprise. The profitability of common bean seed production by farmers is less sensitive to price fluctuations than it is to variety productivity. The study findings further suggest that the introduction of varieties that are better adapted to the environmental stresses such as drought, is likely to enhance the profitability of seed production by farmers at current prices.

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