Uganda Journal of Agricultural Sciences, 2001, 6: 21-25
Printed in Uganda
ISSN 1026-0919

A review of climbing bean variety evaluation and adoption in south western Uganda

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Abstract

From 1989 to 1995, 72 new climbing bean lines were introduced and tested at two variety trial centres in Kabale District south western Uganda. Four of these lines were directly selected from Rwanda for evaluation on farmers field in Kabale. Average seed yield ranged between 444 - 4262 kg ha^{-1} on station and 1592 - 2546 kg ha^{-1} on farm. Farmers observed climbing beans to be high yielding, tolerant to diseases and to possess desirable seed and cooking attributes. The genotypes Umubano and Urunyumba were the two lines most preferred by the farmers. Seed exchange of introduced climbers occurred among farmers within and between villages and was highest for most preferred lines. Climbing beans are, however, susceptible to birds and rats and are labour intensive because of their need for stakes.

Key words: Climbing beans, farmers' selections, seed exchange

Introduction

The common bean, *Phaseolus vulgaris L.* is the most important legume crop in Uganda, being widely grown by small scale farmers and providing the major source of protein in the diets of poor resource communities. Across Uganda, bush beans predominate with on farm yields averaging 700 kg ha^{-1}, reflecting the low yield potential of local cultivars and their susceptibility to abiotic and biotic factors. Climbing beans however, have a yield potential two times that of bush beans but require more fertile soils and take longer to mature than bush beans (Sperling, *et al.,* 1994 and Niringiye, 1994). Because of their high yielding potential, climbing bean lines from Rwanda were introduced and evaluated on-station and on-farm to identify suitable cultivars for dissemination to farmers. In Uganda, the climbing beans are grown for food and cash at altitudes ranging from 1500m -2300 masl in Kabale and Kisoro districts in south-west Uganda and in Mbale district in eastern Uganda (Grisley, *et al.,* 1992).

The objectives of this publication were to review research work conducted on evaluation and adoption of climbing bean varieties in southwestern Uganda since 1989 to 1994. It is envisaged that the publication will be useful to bean researchers, policy makers, donors and non government organizations (NGOs), concerned with improving bean productivity in Eastern, Southern and Central African region.

Materials and methods

From the first season of 1989 (89a) to the first season of 1995 (95a), different climbing bean lines were introduced from Rwanda and evaluated in replicated yield trials in both seasons of each year at Kachwekano Variety Trial Centre, at an altitude of 2100 masl, and at Kalengyere Research Station, at an altitude of 2300 masl, in Kabale district in south-west Uganda. Trials' design were randomized complete block, replicated three times, with plots of four rows measuring four meters and spacing of 0.70 by 0.20 meters between rows and within plants respectively. Either one or more of the local cultivars Rusiipi, Kanyebwa and Kanyamunyu were included in each trial.

Each year, a maximum of twenty lines with superior seed yield and disease reaction, acceptable maturity and seed characters were selected for further testing in the subsequent year (Table 1). Consequently, four most promising lines, namely, Flora, Vuninkingi, Ngwinurare and RWV-295 were selected and tested on-farm in 1994 and 1995.

Results and discussions

The sixteen entries tested in 1989 revealed the high yield potential of climbing beans when conditions are favourable and appropriate management practices are applied. The lowest yielder was ZAV83052 at 2252 kg ha^{-1} and the highest

was genotype 5.700 at 6314 kg ha^{-1}. The range in seed yield observed in other years is shown in Table 2. Screening of germplasm at Kachwekano VTC over eight seasons showed differences in seed yield range for favourable and unfavorable seasons, which ranged from 1551 kg ha^{-1} – 6314 kg ha^{-1} and 636 kg ha^{-1} – 2687 kg ha^{-1} respectively (NBP, 1994). However it was noted that when the season is not favourable for climbing beans, bush beans perform better and vice versa (Table 2). Mean on-farm seed yield of all lines exceeded 1000 kg ha^{-1} for all parishes as presented in Table 3. Umubano, a small red-seeded line gave the highest seed yield consistently on all farms followed by Urunyumba. Variety Kanyebwa yielded least

Table 1: Number of introductions and selections, of climbing bean lines evaluated from 1989 to 1995 in Uganda

Year[1]	New introductions for yield	Tested on VTCs testing	Selected for further testing	Introduced and tested directly on-farm
1989	16	16	1	-
1990	36	37	20	5[2]
1991	7	27	14	6[2]
1992	6	20	3	-
1994	13	16	16	4[3]
1995	1	17	10	4[3]

[1]No testing conducted in 1993
[2]On-farm testing comprised four introduced lines and one local check in 1990 and two in 1991
[3]On-farm testing comprised four lines selected from replicated yield testing (from 1989 to 1992)

Farmers' evaluation of climbing beans

Farmers observed climbing beans to be high yielding and tolerant to diseases (Table 4). Climbers were noted to possess desirable seed colour, seed size and good taste. Both leaves and dry seed were reported to take shorter cooking time compared to bush beans, which is an advantage in saving fuel. With the attributes mentioned above, climbers are likely to attract market easily and be a cost-effective venture because of improved productivity per unit area.

The farmers however observed that climbing beans were susceptible to birds and rats. Mouse-birds, *Collins striatus* damage floral buds and young pods, which consequently lead to lower seed yields. Rats cut the stems at ground level and destroy tender pods. Flora, a medium seeded line has been observed to be less susceptible to bird damage at Kachwekano, making selection for bird non preference a feasible venture (Namulonge Agricultural Research Institute 1995). It is however important to develop simple techniques for either denying the pests access to the plants or physically trapping them for the farmers to get maximum yields.

Farmers infrequently observed that cooked climbing beans become rancid soon after cooking and cannot be saved for the next meal. Farmers in Rwanda reported major problems related to climbing beans to be: need of more fertile soils, long time to maturity and labour in gathering staking materials (Sperling *et al.*, 1994). This observation has also been made by the NBP in Uganda with some farmers.

Staking materials as are requirement for climbing bean were not specifically mentioned as a problem while soil fertility was infrequently reported as serious by 4.6% of the farmers who were interviewed. This may suggest that some problems, which may be important to farmers before they have experience with a technology, may become less important in the process of technology testing with the farmers. According

Table 2: The range in mean seed yield (Kg ha^{-1}) of climbing bean introductions and bush bean breeding materials over five years at VTCs in Kabale

Year /Season	Location	Climbing beans			Bush beans		
		Mean range (0.05)	Lsd	No. of genotypes tested	Mean range	Lsd (0.05)	No.of genotypes tested
1989B[1]	Kachwekano	2252 - 6314	1831	16	nb	nb	nb
1990A	Kachwekano	794 - 2426	ns	8	nb	nb	nb
1990B	Kachwekano	444 - 3636	1635	29	nb	nb	nb
1991A	Kachwekano	1111 - 3667	ns	27	97 - 958	198	23
1991B	Kachwekano	851 - 2687	956	20	766 - 1511	ns	25
1992A	Kachwekano	953 - 2390	ns	20	nb	nb	nb
1992B	Kachwekano	1592 - 3186	1313	20	330 - 1567	493	25
1994A	Kachwekano	636 - 1412	825	16	820 - 2697	724	25
1994B	Kachwekano	2190 - 4262	1030	16	352 - 3056	593	25
1995A	Kachwekano	667 - 1540	ns	17	1241 - 2604	ns	25
1995A	Kalengyere	1551 - 4027	948	17	nb	nb	nb

[1] = A - First growing season ; B - Second growing season
nb = No bush bean trial planted
ns = Not significant

Table 3. Seed yield(Kg ha^{-1}) of six climbing bean genotypes tested on Farmer's fields in Kabale district during 1990 and 1991

Genotypes	Parish/Year							
	Kabale munic. 1990	Nyanja 1991	Nyamabale 1990	Nyaruhanga 1991	Kitumba 1990	1990	1991	Mean
Umubano	2542	2171	2765	2475	2303	2574	1298	2304
Gisenyi	1698	1415	2093	1529	1648	1312	1275	1567
Urunyumba	2604	1666	1969	1910	1026	1475	1195	1692
Kanyebwa	ni	ni	ni	1315	ni	ni	1478	1379
Kanyamunyu	1490	1784	1724	1508	1401	1753	1442	1586
G13671	1490	ni	1892	ni	971	2003	ni	1589
LSD(0.05)	342	na	139	na	147	76	na	
CV (%)	34.9	na	29.8	na	28.2	15.6	na	

to Grisley *et al.* (1992), lack of stakes was not considered a major problem by 85% of respondents who indicated that stakes were bought. The major reason is therefore likely to be related to the inconvenience of managing climbing beans when compared to bush types. Another reason may be gender oriented; since beans are mainly cultivated by women, they may find it harder to gather stakes, a job which is normally for men. Also men own most of the trees. Involving male farmers in climber bean production is therefore likely to speed up the rate of climbing bean adoption.

Based on a 1 - 5 scale, Umubano was rated best by 78% of the farmers followed by Gisenyi and Urunyumba, which were scored by 70% and 56% of the farmers respectively (Table 5). G13671 was scored by none in the first position but was scored by 70% of the farmers as poor or very poor (Table 5). Genotype G13671 is not a true climber; its growth habit varied with environment and was not as vigorous as the other climbers. Involvement of the farmer in variety development gives a breeder confidence in the material that is finally to be presented to the variety release committee. It is also apparent that there are many hidden factors such as shelf life of cooked beans and tenderness of leaves, which may not be easy for a researcher to assess.

Since the exercise to get data from farmers is often carried out in a hurried manner due to time constraint, caution should be taken when analyzing responses given by farmers. Ideally farmers need reasonable exposure to technology before they can give their analysis. A period of five years after a technology has been with the farmers gives them a better understanding of the exact nature of a technology. In a survey by Grisley *et al.* (1992) in Kabale concerning climbing beans adoption, they found that the farmers were in the preliminary learning stage in the application of climbing technology. They therefore need follow- up to master the technology since climbing beans require both new and unfamiliar management methods and cash inputs when compared to bush types

Farmer-to-Farmer Seed Transfers

There was seed exchange of new climbers among the farmers (Grisley *et al.*, 1992). Eighty six percent of households in the

Table 4. Percentage of farmers assigning negative and positive attributes for a range of agronomic characters for six climbing bean genotypes testedon farm over two years in Kabale District.

Character	Years/%Farmers		
	1990	1991	Average
High yielding	57.6	44.2	50.9
Low yielding	20.3	10.2	15.5
Tolerant to diseases	32.3	10.5	21.4
Susceptible to diseases	27.8	8.9	21.4
Early maturing	10.3	13.2	11.8
Late maturing	7.0	8.8	7.9
Not liked by birds	4.0[2]	18.3	11.2
Liked by birds	16.0	NR[1]	16.0
Not liked by rats	4.0[2]	4.7	4.4
Liked by rats	3.0	30.8	30.4
Good seed colour	16.2	19.6	17.9
Poor seed colour	4.0	NR	4.0
Good seed size	18.3	30.1	24.2
Poor seed size	39.0[2]	8.1	23.7
Leaves cook fast	17.2	-	17.2
Leaves cook slowly	4.0	-	4.2
Seed cooks fast	18.2	31.2	24.7
Hard seed coat	4.5	4.9	4.5
Soup tastes good	7.3	38.7	23.0
Soup tastes poor	8.5	12.7	21.2
Seed has good taste	39.8	38.7	39.3
Seed has poor taste	7.01	2.7	9.9
Long shelf life after cooking	NR	4.5	4.5
Short shelf life after cooking	4.0	6.9	5.5

area surveyed made requests for seed of introduced climbers.

In 1991A, a total of 109 Kg. of the introduced climbers was delivered through farmer to farmer seed transfer system by eighty five percent of farmers who had on farm trials, while only 37 kg of seed was delivered by fifty five percent of the farmers during 1991B. Through this system farmers from other villages were able to receive the new seed.

Sperling *et al.*(1993) have revealed that rate at which farmers distribute seed among themselves is positively correlated to variety survival. It was observed that when poorer farmers receive new varieties, there is cycle of loss and restocking of the varieties even when they are appreciated among small holders involved. For adoption of varieties among such farmers, repeated and continued support is needed. The total number of farmers who received new bean types in 1991a was 122 out of whom 95 were from the same village while 27 were from other villages. However only 68 farmers received the new climbers seed in 1991b. Genotypes Umubano and Urunyumba were the most frequently disseminated varieties followed by Gisenyi (Table 6).

Conclusion

The observations made indicate the seed yield of climbing bean to be the driving factor that has attracted farmers. There is general interest shown by the farmers in climbing bean

Table 5. Over all rating of five climbing beans genotypes grown on farmers fields in Kabale District during 1990

Genotype	Score[1]			Major attributes.	
	Very good or good	Average	Very poor or poor	Positive	Negative
Kanyamunyu	39	35	22	Matures early Good taste Desirable seed size	Susceptible to disease Liked by birds and rats
Umubano	78	17	4	High seed yied Tolerant to diseases Leaves cook fast	Poor seed size
Urunyumba	56	30	0	Matures early High seed yield Tolerant to diseases Disirable seed colour Seed cooks fast Good taste	nr
G13671	0	17	70	nr	Low Seed yield Susceptible to diseases Liked by rats

[1]. 5 = Very Good ; 4 = Good ; 3 = Average ; 2 = Poor ; 1 = Very Poor.
nr. = Not rated by any farmer

Table 6. Farmer to farmer seed transfer of climbing bean genotypes by 23 farmers who participated in on farm trials in 1990 and 1991 in Kabala District

Item	Genotype/Years									
	Umubano		Urunyumba		Gisenyi		G13671		Kanya	
	91a	91b	91a	91b	91a	91b	91a	91b	91a	91b
Farmers surveyed (%)	55	48	55	28	48	34	20	14	45	41
Farmers growing transferred seed (%)	68	56	76	36	73	45	67	44	71	52
Amount transferred per farm (kg)	16.4	12.1	14.6	6.2	15.4	6.8	5.7	2.4	15.7	9.4
Total farmers that received seed	67	27	38	29	61	6	19	12	58	30
Average quantity of seed received (kg)	0.2	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Average number of farmers receiving seed	3.7	1.1	2.0	1.3	3.8	1.6	2.7	1.3	3.6	1.4

Source: Grisley *et al.* (1992)

production despite clear requirements associated with their production. The most important problems are bird damage and the cost of staking materials as well as labour that is involved. It is suggested that farmer-to-farmer Climbing bean technology transfer activities be initiated for farmers in Kabale to learn from fellow farmers in Kisoro district who have adopted climbing bean production.

The problem of birds will become less, as the area under climbing beans gets higher. Farmers in Kicumbi have developed a bird trap using fish net. Such technique should be developed further and be adopted by other farmers in the district

Due to the short period at which the surveys were made after the on farm trials were initiated, an impact assessment study is important to follow up the participating farmers and evaluate their view about the climbing beans genotypes after they have grown them now for six years.

For more effectiveness in popularizing climbers, collaboration with other institutes and NGOs in the district should be strengthened. Collaboration with ICRAF for example will provide techniques by which fast growing tree species can be incorporated as a means of securing staking material. Use should be made of bands separating different fields by planting there multi - purpose tree species or elephant grass which can be ready for stakes within two seasons. Further collaboration with CARE - an NGO operating in the area gives the opportunity to reach more farmers since CARE operates at grass root level in the villages. Effort on climbing bean introduction should be consistently carried out in a specific location or locations and an economic analysis with the farmer be conducted so that the farmer may get first hand information on the profitability of the climbers. It should however not be expected that adoption of climbers will take place after a short time of exposure since climbers have a different management requirement. The farmers have to learn how to manage climbing beans.

The farmer-to-farmer seed transfer method creates a 'multiplier effect' in seed dissemination and can result in significant numbers of farmers receiving new technologies within relatively few seasons. The results show that farmers who have preference for a variety will produce it and disseminate it among other farmers.

Though the out look for the future is promising, more work need to be done through new introductions and selections both on station and on- farm as well as promoting use of farmer to farmer techniques for fast technology transfer and adoption.

Acknowledgements

The authors wish to acknowledge the Uganda National Beans Program (UNBP) and CIAT on whose reports this review is based.

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