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Agronomic description of new improved climbing bean varieties

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Abstract

Eleven genotypes including one local check (Kanyamunyu) were grown in a trial at Kachwekano and Namulonge in 1996a, 1996b and 1997b. The trial was arranged in a randomized complete block design replicated three times. Staking was carried out at V⁴ stage and description was made for the following agronomic characters: disease infection, days to flowering, days to maturity, seed yield, seed size and cooking time. Genotypes Umubano, Ngwinurare, RWV 296 and Vuninkingi were identified for release as new bean cultivars in Uganda. Both genotypes are climbers and mature within 81-115 days. Depending on the growing conditions, the seed yield was 700 to 3800 kg/ha. Cooking time varied from 40-70 minutes depending on variety. Varieties with most preffered seed characteristics were Ngwinurare and RWV 296. Variety Ngwinurare was reported by IDEA project to posses attributes suitable for export market. Varieties Umubano and Vuninkingi performed well in both low and high altitude environments.

Key words: Climbing bean genotypes, farmer preferences, altitude environments.

Introduction

Climbing beans are an important crop in ensuring food security due to higher yields per unit area, better resistance to diseases and ease in drying during heavy rainfall due to staggered harvesting (David 1996). The climbing bean technology is particularly suitable for areas of high population density and land shortage. In a survey carried out by CARE International in Kabale, the highest seed multiplication ratio for climbing beans was 1:35, while it was 1:6 for bush beans (Nuwagira, 1995). In the same report damage caused by birds and rats and the need for staking materials were the major setbacks, to climbing bean production while David, 1996 reported that the major constraint to wider adoption of climbing beans in Mbale was seed availability and lack of reliable market.

The most important agronomic characteristic possessed by a new bean variety according to farmers preferences in Kabale, Kampala and Iganga were high yield, disease tolerance, seed size, testa hardness and adaptability (Anon 1996). David, (1996) reported evidence that market demand is an important determinant of the adoption of new varieties and that farmers want a variety which they can eat and sell. All this is dependent on seed yield and variety characteristics most desired by farmers and consumers. In Rwanda, the use of improved climbing beans annually fetched 31-66 thousand additional tons of beans, equivalent to an extra 8-15 million US dollars for Rwandan farmers (Sperling et al., 1994).

The objective of this study was to evaluate 11 climbing bean genotypes and select the most promising ones based on the farmers preferences of seed yield, resistance to diseases, seed size, cooking time, adaptability, days to maturity, cooking time and seed colour.

Materials and methods

A trial with eleven entries including one local check Kanyamunyu was planted at Kachwekano in Kabale district at an altitude of 2100 m and at Namulonge whose altitude is 1150 m. in three seasons of, 1996a, 1996b and 1997b. It was arranged in a randomized complete block design, with a spacing of 60 cm between rows and 20 cm within rows. The plot size was 2.5 m x 4 m accomtuodating four rows and the entries were replicated three times. Staking was carried out at V4 stage(third trifoliate leaf) with stakes measuring approximately two metres.

Data on diseases was recorded at early R8 stage(pod filling). Other agronomic data was recorded on the following characters: disease infection, days to flowering, days to maturity, seed yield per hactare, seed size and cooking time.

At R9 stage(maturity), the entries were harvested, threshed and dried to about 12% mc and weighed. The plot yield in kg was converted into kg ha^{-1}, seed size was determined as weight of 100 seeds.

The seed yield data was analyzed using MSTATC version 1.42 computer software. Analysis of variance was carried out for each location and season to assess variation within treatments and a combined analysis of the two locations was also conducted to assess the significance of Genotypex Environment interactions.

Results and discussion

Seed yield in kg ha^{-1} of the nine genotypes are presented in Table 1. Yield during1996a was poor due to prolonged dry spell experienced when the crop was at critical stage of pod formation. In 1996b yield ranges of 785-2667 kg ha^{-1} and 1570-2563 kg ha^{-1} were observed at Namulonge and Kachwekano respectively. The yield difference was however not significant. This can be attributed to the fact that all the genotypes tested had earlier on been selected for their high yield. Significant yield differences were only observed at Namulonge in 1997b with yield of 1541-3622 kg ha^{-1}, while yield at Kachwekano varied from 1500 and 3875 kg ha^{-1}. 1997b season experienced unusually high amount of rainfall which can be attributed to the high yields observed (Anon 1996). In terms of seed yield, variety Vuninkingi was the best performer followed by Ngwinurare and Umubano. These varieties together with RWV 296 have been submitted to variety release committee for recommendation as new improved varieties.

Table 1. Seed yield (kg/ha) of 11 climbing bean genotypes tested at two locations in 96A, 96B and 97B

	Location/season						
Genotype	NAM 96a	KAC 96a	NAM'96b[2]	KAC96b	NAM 97b	KAC 97b	Mean
AFR 13	993	793	1185	1733	1815	1511	1338
Flora	760	853	1467	1630	2185	2200	1516
G 2331	1060	800	1022	1630	2548	3106	1694
Umubano	647	787	1126	1570	593	3000	1787
Kiruli	633	1273	674	2000	2145	1742	1411
Ngwinurare	973	1033	2667	1822	1541	3861	1983
RWV 163	1073	1373	711	2563	2593	2125	1740
RWV 295	973	607	1378	1659	2844	2667	1688
RWV 296	793	700	830	1659	1222	1500	1117
Vuninkingi	627	687	785	1659	3622	3875	1876
Kanyamunyu	1080	1173	652	1452	652	1452	107
Mean	853	891	1136	1762	2251	2458	1566
LSD (0.05)	NS	NS	NS	NS	713	NS	
CV %	35.3	46.4	18.48	27.58	18.98	57.36	

[1]NAM = Namulonge; KAC = Kachwekano
a = First growing season; b = Second growing season

The response of genotypes to disease infection is presented in Table 2. Angular leaf spot was the major disease affecting the climbing bean varieties at both Namulonge and Kachwekano. Varieties RWV 296, Ngwinurare and the local check were the most affected. In general the climbers were resistant to most of the diseases and matured within 81-115 days depeding on variety (Table 2).

Table 2. Agronomic traits of eleven climbing bean genotypes tested at Namulonge and Kachwekano in 1996b (mean of 2 locations)

Genotype	Days to flowering	ALS	RUST	CBB	RAM	ASCO	BCMV	ATH	Days to maturity
AFRI 13	45	4.0	1.5	2.2	1.2	4.0	6.7	1.3	103
Flora	43	4.9	2.0	4.2	6.2	4.3	2.0	1.3	98
G 2331	45	4.5	1.5	2.7	2.9	3.7	6.3	1.3	102
Umubano	43	3.7	1.8	3.4	1.7	3.0	2.0	1.0	94
Kiruli	42	6.3	2.0	3.3	4.5	3.0	2.0	2.3	99
Ngwinurare	43	6.5	2.0	3.5	3.4	3.0	2.0	2.0	95
RWV 163	48	3.2	1.2	2.0	6.0	3.0	2.0	1.3	100
RWV 295	47	5.7	1.5	2.7	1.7	3.0	4.3	1.3	95
RWV 296	43	6.0	2.0	2.5	2.2	3.0	2.0	3.7	103
Vuninkingi	46	3.4	1.7	3.0	1.3	3.0	3.0	1.7	95
Kanyamunyu	43	6.4	2.7	3.4	3.7	3.0	2.0	1.7	91
Mean	44	4.9	2.03	3.0	3.1	3.3	3.0	1.9	98
LSD (0.05)	3.15	NS	NS	NS	0.97	0.5	0.7	0.9	NS
CV %	3.21	23.77	66.07	24.39	13.86	8.99	13.98	27.14	6.04

1 - 2 = Resistant; 4 - 6 = Intermediate; 7 - 9 = Susceptible
ALS = Angular leaf spot; CBB = Common bacterial blight; RAM = Ramularia; ASCO = Ascochyta blight; BCMV = Bean common mosaic virus; ATH = Anthracnose

A summary of Agronomic description of the nine genotypes is presented in Table 3. Varieties with the best seed characters as desired by farmers was Ngwinurare, RWV 296, Vuninkingi and Umubano. The former two are particularly large seeded; Umubano and Vuninkingi are well adapted to both medium and high altitude seed quality. Variety Ngwinurare was reported by Uganda=s Investment in Developing Export Agriculture(IDEA) to possess seed characteristics suitable for export, which is good news to farmers in regard to market for their produce. Cooking time of the varieties varied from 40-70 minutes which is lower when compared to bush beans which take 50-90 minutes. Anon, 1996; Anon, 1997; David and Hoogenijk, 1997 have reported Varieties Umubano, Ngwinorare and RWV 296 as acceptable in Mbale, Kabale and Mpigi districts(Table 3).

Table 3. Seed traits most desired by farmers of the four selected varieties

	VarietyName			
	Umubano	Vuninkingi	Ngwinurare	RWV 296
Yield (kg ha1[1]	600-3600	600-3900	900-3900	700-1700
Seed colour	Red	Red/maroon	Red	Striped cream
Seed size		Small	Small	Large Large
Seed weight(100 seeds)	29	30	49	50
Cooking time (minutes)	50-60	50-60	40-60	50-60
Adaptation (metres above sea level)	1100-2100 m	7100-2100m	2100 m	2100 m
Acceptability	Highly accepted in Mbale	fairly accepted in Kabale	highly accepted in Kabale and Mpigi	fairly accepted Kabale and Mbale

Conclusion

Climbing bean technology is highly recommended for production in areas where there is a problem of land shortage. This is because of the high seed yield per unit area produced by climbers. The problem of staking materials can be resolved by planting multi-purpose tree species recommended by agroforestry research scientists such as Calliandra.

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