

## SELECTION OF BEAN LINES TOLERANT TO LOW SOIL FERTILITY CONDITIONS IN AFRICA

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### Introduction

Low soil fertility is the main factor that constrains bean crop yield to a great extent in most bean production areas of the Central, Eastern and Southern Africa. The major soil fertility related problem are low available N and P, and soil acidity.

Bean is generally grown by small scale farmers with very little input to improve soil productivity. Genetic approach to identify bean genotypes adapted to soils with inadequate nutrient supply and low pH associated nutritional disorders as a complement to soil management is considered to be a sound strategy for a better bean crop productivity.

During the last decade attempt to identify genotypes adapted to low soil fertility through a Pan-African effort by a working group called Bean Improvement for low Fertility Soils in Africa (BILFA) indicated considerable genetic variability in bean germplasm for adaptation to low soil fertility (Wortmann *et al.* 1995). However, most tolerant lines selected were not often of the regionally preferred seed types, hence focus in BILFA III was major market classes, particularly large seeded Andean types.

### Materials and Methods

BILFA III, initiated in 1998 had originally 200 lines, which were evaluated for low fertility soil adaptation. These materials were evaluated at several sites, each with a specific stress:

- Low N: Namulonge/Uganda, Selian and Maruku/Tanzania, Bembeke/Malawi
- Low P: Rubona/ Rwanda, Kakamega/Kenya and Misafu/Zambia
- Low pH: Mulungu/Congo and Antsirabe/ Madagascar.

For two seasons, all entries were evaluated at moderate stress, when a well adapted control variety under stress performs at 40 to 50 % of its normal unstressed performance and the best top 50 percent lines are selected. The 50 selected lines are then evaluated further under moderate and no stress conditions for two or three seasons. Lines having performed well under limited N and P supply and acid soil conditions are considered tolerant.

### Results and Discussion

Among 200 original set of materials evaluated at different locations under different stresses, several lines gave consistently higher yield compared to local checks and previously selected tolerant checks. Twenty-eight lines were found tolerant to low N and 29 tolerant to low P and acid soils conditions (Table 1). Large seeded materials with 100-seed weight of 40 g or better, are found in all tolerance groups, although most were in the low N tolerant group. Calima types seeds were also common.

**Table 1: Low soil N, P and acidity tolerant lines selected from BILFA III nursery.**

Low N			Low P			Low pH		
Line code	Seed Size	Seed color	Line code	Seed size	Seed color	Line code	Seed size	Seed color
A 286	17	Carioca	AFR 619	34	Red	37/66/6	23	Tan
AFR 675	24	Navy	AFR 675	24	Navy	A 286	17	Carioca
AFR 699	40	Red	AFR 708	44	Calima	A 344	27	Cream
AFR 714	23	Navy	AFR 714	23	Navy	AFR 708	44	Calima
AND 871	35	Calima	AND 871	35	Calima	AFR 714	23	Navy
CAL 143	50	Calima	ARA 4	21	Cream	ARA 4	21	Cream
CAL 150	50	Calima	CIM 9314-36	41	Calima	BRB 119	31	Calima
CIM 9314-33	42	Red	CIM 9314-37	34	Calima	DB 201/77/1	19	Navy
CIM 9314-36	41	Calima	CIM 9331-1	25	Red	CIM 9314-3	37	Calima
CIM 9315-1	24	Pink	CIM 9331-2	29	Pink	CIM 9331-1	31	Red
CIM 9315-3	27	Calima	CIM 9331-3	23	Red	CIM 9415	38	Calima
CIM 9318-4	27	Calima	DB 196	20	Navy	CNF 5520	44	Calima
CIM 9331-3	23	Red	DOR 663	17	Black	DFA 53	28	White
DB 196	20	Navy	FEB 192	19	Cream	FEB 197	22	Black
DOR 715	18	Red	FEB 196	20	Carioca	G 12489	44	Calima
FEB 192	19	Cream	G 2858	21	Tan	G 2910	21	Calima
FEB 196	20	Carioca	G 5889	15	Cream	G 3480	15	Black
G 5889	15	Cream	LSA 32	32	Carioca	G 5889	15	Cream
LSA 32	32	Carioca	MORE 92018	49	Tan	HM 21-7	45	Red
MORE 92018	40	Tan	PAN 150	24	Carioca	LRK 34	45	Pink
PAN 150	24	Carioca	RWR 1873	35	Calima	LSA 144	22	Red
PRELON	20	Navy	RWR 2075	44	Red	PAN 150	24	Carioca
RAB 482	17	Red	RWR 2091	37	Red	RAB 482	17	Red
REN 22	21	Navy	SDDT 49	20	Carioca	RWR 1742	22	Red
RWK 10	40	White speckled	SDDT 54-C5	31	Pink	RWR 1873	35	Calima
SDDT 55-C4	42	Calima	UBR(92)24/11	15	Navy	UBR(92)11	18	Carioca
UBR(92)25	18	Navy	VEF 88(40)L1PYT6	24	Red	VEF88(40)L1PY T6	24	Red
VEF88(40)L1PY T6	24	Red	XAN 76	18	Calima	XAN 76	18	Cream
			ZAA 5/2	33	Cream	ZAA 5/2	33	Calima

Many lines showed multiple tolerance, having performed well under at least two stresses. These were: ARA 4, A 286, AFR 675, AFR 708, AFR 714, AND 871, CIM 9314-3, CIM 9314-36, CIM 9331-1, CIM 9331-3, DB 196, FEB 192, FEB 196, G 5889, LSA 32, PAN 150, RAB 482, RWR 1873, VEF 88(40)L1PYT6.

### Conclusion

The results show the existence of tolerance to low soil fertility in market classes bean types. These materials need to be promoted and disseminated for wider impact. The promising varieties identified have opened a new opportunity for higher bean productivity on acid soils and those with limited N and P supply especially for resource poor farmers with limited ability to apply other soil amendments. Some of the tolerant varieties have performed well on-farm and have been released in some collaborating countries. Others are included as parents in national and regional breeding programs.

### References

Wortmann, C.S., Lunze, L., Ochwoh, V.A. and Lynch, J.P. 1995. Bean Improvement for Low Fertility Soils in Africa. *African Crop Science J.* 3(4) 469-477