

**INTERACTION AND SELECTION FOR YIELD IN BEANS OVER SEASONS
IN UGANDA.**

H. E. GRIDLEY.

(Regional Breeder, CIAT, PO Box 6247, Kampala, Uganda.)

In the Ugandan bean breeding programme selection for improved yield is conducted in a structured series of trials, grown in the principal bean producing areas, with fewer selected lines being tested at an increasing number of sites in contiguous seasons. Genotype-environmental parameters have been derived from such trials to evaluate the frequency of across season interactions and their effect on selection for yield.

Of the 58 across season anovars conducted for yield over contiguous seasons from 1989 to 1991, involving 10 or more lines and 17 site combinations, 26 or 45% were significant ($P \leq 0.05$) (table 1), indicating substantial heterogeneity in line performance between sites over seasons. Moreover, a significant correlation of 0.78 ($P \leq 0.01$, $df=15$) between the number of significant interactions and analyses conducted for the 17 site combinations indicated that 45% maybe an underestimate.

Sites showed large differences in the frequency of interactions, ranging from 28% for Kamenyamigo (KY) to 65% for Kabanyolo (KB), although data over other seasons are required to confirm these levels particularly for the three sites involved in relatively few analyses. The low frequency for the former largely stemmed from the absence of an interaction with Kawanda (KA) on eight (out eight) occasions suggesting redundancy in using both sites in the testing programme. However, their interactions with other sites show both contributed unique yield data on the lines thus helping to identify lines with a superior yield over the differing bean growing environments. Reduction in testing sites can help in saving scarce resources in times of budgetary constraint, but further analyses over more seasons are needed to identify those sites that could be eliminated without serious loss of information on genotypic performance. Also a site's value to within season multisite testing should be evaluated prior to any elimination.

The effect of these interactions on selection for yield was assessed in eight breeding phases, each involving 32 or more lines selected for improved yield and grown in a different set of trials over two contiguous seasons from 1989 to 1991 (table 2). In spite of the interactions, overall selection for yield was effective with the mean yield advantage of the lines, expressed as a percentage over K20, a popular cultivar and the control in all trials, evident in the two contiguous seasons in all phases except the sixth. The lack of concordance in ranking over seasons, aside from phase 5, indicated the predominance of qualitative rather than quantitative interactions (Baker, 1988) in genotypic variation over seasons. A linear yield correlation between seasons for phases with multisite testing in the first season showed that this can help reduce the deleterious effect of the interactions.

Interactions over sites must be expected and emphasise the need for multisite testing at all stages of testing, particularly in the preliminary yield trials. Interactions, however, are a statistical entity and careful evaluation of their practical effect on selection should always be evaluated.

Table 1. Frequency of genotype x environment interactions over seasons for yield at six sites from 1989 to 1991 in Uganda.

Site	Interactions/total anovars (1)						Total	% of significant interactions	
	Site combination								
	KA	BK	KB	KY	MA	RU			
Kawanda (KA)	3/7	1/2	6/9	0/8	2/4	1/3	KA	13/33	39
Bukalasa (BK)	- (2)	1/1	0/1	-	-	-	BK	2/4	50
Kabanyolo (KB)		6/9	3/4	0/1	1/2	1/2	KB	17/26	65
Kamenyamigo (KY)			0/2	1/2	1/1	1/1	KY	5/18	28
Masindi (MA)				0/1	0/1	0/1	MA	3/9	33
Rubare (RU)						-	RU	3/7	43

1. Numerator: number of significant ($P \leq 0.05$) interactions detected; denominator: total number of across site anovars conducted.
2. No data.

Table 2. Relative yield performance (as a % of K20) of selected lines over two contiguous seasons in eight breeding phases in Uganda from 1989 to 1991.

Phase	No. of lines	Yield (%K20) season ³		Correlation ¹ over seasons		No. of sites ² season	
		one	two	rank	linear	one	two
1	46	118	118	-0.04	0.05	1	3
2	42	114	114	-0.01	0.10	1	3
3	40	111	115	-0.02	-0.011	1	4
4	43	142	133	-0.14	0.37*	3/4	3
5	32	138	141	0.53*	0.08	3/4/7	5
6	40	113	81	0.02	0.67***	3	2
7	45	186	160	0.07	0.49***	2	2
8	32	155	139	0.06	0.72***	3/5	4

1. * and ***: significant at $P \leq 0.05$ and $P \leq 0.001$ respectively.
2. Multiple numbers refer to trials grown at differing number of sites.
3. One and two were contiguous seasons.

REFERENCE.

Baker, R J (1988b). Analysis of genotype-environmental interactions in crops. Animal and Plant Sciences, 1, 1-4.