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RATE AND DURATION OF SEED FILLING IN MUNGBEAN *(VIGNA RADIATA)*

BY

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ABSTRACT

The rate and duration of seed filling and their relationship with seed yield were investigated at Makurdi in 2003 and 2004 cropping seasons using five mungbean cultivars (Local, VC 2768A, VC1178A, VC 2778A and VC 1973A). Results from the analysis of variance (ANOVA) showed that the cultivars differed significantly in duration but not in rate of seed fill. Correlation analysis could not detect any significant relationship between rate and duration of seed fill and seed yield or any of the yield components. As such it has been concluded that these two seed growth characters may be unsuitable for use in predicting Mungbean seed yield, as is the case with other crops such as soybean.

Keywords: Rate, duration, seed filling, Mungbe an.

INTRODUCTION

Mungbean or green gram *(Vigna radiata* (L) Wilczek) is an important food legume that is native to South East Asia and is cultivated primarily in Asia, Africa, South and North America, and Australia mainly for its protein rich edible seeds (Kay, 1979; Bhardwaj *et al.* 1999). Mumgbean seeds can be consumed whole after boiling and are said to be highly digestible and free from flatulence associated with legumes such as cowpea. Seed could be ground into flour and used in various bakery products and snack foods. The seeds as well as the straw can be used as animal feeds while the plant could serve as green manure or cover crop. (Kay, 1979).

In Nigeria, mungbean is not yet an established crop (Mahmud, 1996). As such official production statistics seems unavailable. However, reports from experimental sites so far have given seed yield of less than 1000 kg/ha, which is far less than what is obtained elsewhere (Ugese and Adedzwa, in press). This has justified the need for mungbean yield improvement.

Two seed growth characters capable of affecting seed yield of crops are rate and duration of seed filling (Patterson and Raper,1985).The two characters are considered possible measures of physiological efficiency (Daynard *et al* 1971) and are influenced by both genetic and environmental effects (Jones *et al.*, 1979, Cure *et al.*, 1983, Egli *et al.*, 1984). If their relationship to seed yield is positive, they could be used as selection criteria in breeding mungbean cultivars with high yield potential.

A positive relationship between grain filling duration and grain yield has been reported in maize (Daynard and kannenberg, 1976), barley (Rasmusson *et al,* 1979) and rice (Jones *et al.*,1979).In soybean, the duration of seed fill (Egli and Legget, 1973; Nelson, 1987) and the rate

(Kaplan and Koller, 1974) have been shown to be strongly correlated with final seed weight although most studies concluded that duration rather than rate was more closely related to seed yield (Jones *et al.* 1979). The implication is that these two seed growth characters could be used in predicating soybean seed yield (Nelson 1987), thus acting as veritable tools in selecting for high yielding cultivars in a breeding programme.

In Mungbean however, such studies are rare. The only report available to us investigated the effect of planting dates on these two characters (Sarobol *et al.,* 1991). There is however, a serious need to investigate the effect of cultivars on rate and duration of seed filling since they could be genetically influenced. As such, the work reported in this paper was undertaken with two objectives in mind:

1. To find out if there are varietal differences in rate and duration of seed filling.
2. To determine the relationship between these two characters and Mungbean seed yield and yield components.

MATERIALS AND METHODS

The study was conducted at the Teaching and Research Farm of the University of Agriculture, Makurdi (7.41°N, 8.37°E, 400m above sea level) in the Southern Guinea Savanna zone of Nigeria during the 2003 and 2004 cropping seasons. One local and four (4) exotic (VC2768A, VC 1178A, VC 2778A and VC 1973A). Cultivars were used. Seeds of the exotic cultivars were obtained from the Asian Vegetable Research and Development Centre (AVRDC) Shanhua, Taiwan. Planting was done 5th August and 27th July in 2003 and 2004 respectively on soils described as Typic Ustropepts. The experimental design was a randomized complete block replicated four times.

Plots consisted of four ridges, 3m long and spaced 80cm apart. Interplant spacing was 10cm. Hoe-weeding was done 3-4 weeks after planting (WAP) since mungbean is a short duration crop (kay, 1979)while the insecticide 'karate' was sprayed once during the reproductive phase to control insect pests.

During pod formation about 100 uniformly sized pods, 3-4 cm long were tagged in each plot before they could accumulate substantial dry matter. The tagging of similar sized pods was based on the assumption that such were likely to be of approximately the same age (Egli, 1975). Later, 7-10 tagged fruits were harvested at 3-day intervals until when the pods had turned black, indicating harvest maturity. Seeds were removed from the sampled pods, counted and oven dried at 70°C to a constant weight. Mean seed weight was taken at each sampling time.

Seed growth rate was estimated for each plot by plotting the seed weight against time. The slope of the line, where dry matter accumulation in seeds was linear, represented the rate of seed filling. This line was extrapolated to the x-axis (point of zero seed weight) and up to the level of maximum seed weight. The duration of seed fill, called the effective filling period (EFP) was defined by the distance (in days) between the beginning of the EFP (point of intersection of regression line with X-axis) and the end of EFP (point of Maximum Seed Weight) (Stoy, 1980, Gbikpi and Crookston, 1981). Before final harvest,

pods/plant and seeds/pod were estimated from five randomly selected plants in each plat. After harvest, seed yield and 1000 seed weight were estimated from the processed seed.

A separate analysis of each year's data was carried out. Since F-ratio was not significant, the two year's data were combined and analyzed (Gomez and Gomez, 1984). Fisher's Least Significant Difference (F-LSD) at 5% level of probability was employed for mean comparison, where appropriate (Obi, 2002). A correlation analysis among the characters considered was also done.

Mean squares from the analysis of variance of seed growth characters and seed yield are presented in Table 1. Apart from rate of seed fill, all other characters considered showed highly significant effects indicating their degree of variability among the cultivars.

Table 1: Mean Squares from analysis of variance for rate and duration of seed fill, seed yield and yield components

Source of variation	DF	Rate of seed fill (mg/seed/day)	Duration of seed fill (days)	Seed yield (kg/ha)	Pods/Plant	Seed/Pods	1000 seed Weight (g)
Rep	3	0.130	0.007	528.04	2.06	0.19	4.64
Cultivar	4	0.024	0.528*	3240.75*	42.84*	0.93*	7.63*
Error	12	0.038	0.028	281.90	2.94	0.10	0.85

* = Significant at the 5% level of probability

RESULTS AND DISCUSSION

Table 2 contains the mean values of the characters. Thus VC 1178A had the longest duration of seed fill while VC 1973 A had the shortest. However, this did not reflect on their relative seed yields as these failed to differ significantly from each other. In soybean on the other hand, cultivars with longer duration of seed fill have been shown to produce higher seed yield than those with shorter seed fill duration (Nelson, 1987). The relatively poor performance of the local cultivar was probably due to the lower number of pods/plant, seeds/pod and 1000 seed weight. On the other hand fewer number of seeds/pod in VC 1973A appeared to have been adequately compensated for by the high number of pods/plant, It is noteworthy that, the seed yield among these same cultivars, was more variable in an earlier study (Ugese and Avav, 2005).

Correlations between rate and duration of seed fill and seed yield were positive but not significant (r = 0.273, 0.0074). Correlation between these two seed growth characters and all other characters considered in this study was also non-significant (data not shown). This implies that neither rate nor duration of seed fill could be used in predicting mungbean yield. This result contrasts with that obtained in soybean (Egli and Legget, 1973; Nelson, 1987) and some cereal crops (Daynard and Kannenberg, 1976, Jones *et al*, 1979; Rasmusson *et al* 1979). Results however

agree with those of Sarobol *et al* (1991) who could not detect any relationship between the seed growth characters and seed yield of mungbean.

CONCLUSION

The present study has established the existence of differences in duration of seed fill in contrast to rate among cultivars tested. However no significant positive correlation could be found between these characters and seed yield thereby precluding them as predictive indices for mungbean seed yield. However, it might be necessary to include a vast array of cultivars in such a study before more definitive

Table 2: Rate and duration of seed fill, seed yield and yield components of Mungbean

Cultivar	Rate of seed fill (mg/seed/day)	Duration of seed fill (days)	Seed yield (kg/ha)	Pods/Plant	Seed/Pod	1000 seed Weight (g)
Local	3.12	9.4	235.6	18.8	8.8	30.0
VC 2768A	3.09	9.0	293.5	25.8	8.5	32.0
VC1178A	3.16	9.9	316.6	20.2	9.3	33.0
VC 2778A	3.06	9.5	305.8	23.8	9.8	31.2
VC1973A	3.29	8.9	310.6	27.8	8.6	29.0
Mean	3.14	9.3	292.4	23.3	9.0	31.0
LSD (0.05)	NS	0.3	31.6	3.2	0.6	1.7
CV (%)	5.10	1.47	4.69	6.01	2.89	5.61

NS = no significant difference.

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