

Effect of Pollination Time on Seed Set in Short Glume Sorghum (*Sorghum bicolor* (L.) Moench) in Yola

D. Bello

Department of Crop Production and Horticulture,
Federal University of Technology, P.M.B. 2076, Yola, Nigeria

Abstract: Studies on the effect of time of pollination on seed set and viability in short glume sorghum was conducted on the Teaching and Research Farm of the Department of Crop Production and Horticulture Federal University of Technology, Yola. Two sorghum cultivars were used; The Treatments were 6 different timings on which controlled pollination was carried out, after emasculating the female flowers. These timings included 24, 27, 30, 48, 51 and 54 h. Data were collected on seven parameters namely; number of seed set per time, weight of 30 F₁ seeds, percent germination, vigor score, days to 50% flowering, days to 95% maturity and yield per plant to further establish seed viability. The data were subjected to analysis of variance based on Randomized Complete Block Design. Results showed that pollination conducted within 27-48 h out-performed others conducted at other timings; suggesting therefore that 27-48 h as the right time to perform crosses on sorghum in Yola environment.

Key words: Sorghum, emasculating, timing, pollination, yola-environment, Nigeria

INTRODUCTION

Among other requirements for increase production is the supply of high quality seeds to farmers. The formal seed sector (government agencies, seed companies and donor seed projects) however, had considerable impacts on the production and supply of hybrid maize and seeds of other high valued crops such as wheat, soy bean, sunflower etc., but a myriad of seeds of small grain and indigenous crop grown by small holder farmers such as sorghum, have been neglected. In Africa, only in Sudan, Egypt and South Africa, have commercial production of hybrid sorghum been reported (Murty *et al.*, 1994). In spite of the importance of this crop, there are few reports on its pollination time, not only is this information important in understanding the flower biology of sorghum and its implication on hybrid seed production, it is also critical in gaining more insight in the relationship between weather and floral biology of sorghum for the purpose of its improvement practices. Therefore, the purpose of this research is to determine the right time of pollination for viable seed set in short glume sorghum in Yola environment and to carry out germination and seedling vigor tests of the F₁ seeds.

MATERIALS AND METHODS

Experimental entries comprising two mid-maturing short glume (3-4 mm long) sorghum cultivars collected during the 2006 rainy season from sorghum farmers in Girei and Gulak towns of Girei and Madagali local government areas of Adamawa state in Nigeria, respectively. Seeds of these genotypes were stagger planted in an already prepared nursery field. Sowing was done in the ratio of 2:2, males to female rows as described by Murty *et al.* (1994). This was done in 3 replication in the dry season of 2006/2007. At anthesis controlled pollination was carried out on 50 florets in each replication based on the various treatments by hand emasculating technique as described by Leland (1985). This was done in order to obtain F₁ seeds for trial during the rainy season of 2007/2008. The experimental treatments were 24, 27, 30, 48, 51 and 54 h, after emasculating the female flowers, at which controlled pollination was carried out. Germination test was carried out after harvest of the F₁ seeds in the laboratory of the Department of Crop Production and Horticulture FUT Yola, following methods described by Agromisa and CTA (2004) base on each treatment for each replication, while vigor test was carried out on the experimental field of the Department of crop

production and Horticulture FUT Yola, on the basis of visual scoring on a scale 1= poor to 5= good as described by Leland (1985). Five tagged F_1 plants per replicate were sampled for measurements on the following parameters; Number of seed set/time, Seed weight, Percent germination, Vigor test, Days to 50% anthesis, Days to 95% maturity and yield per plant. Data generated from all measured parameters were subjected to a 2 factor analysis of variance as described by Akindele (1996), using the PROC GLM procedures of the SAS Statistical Software Package for windows (SAS, 1999). Mean separation was performed using DMRT ranking of the same Software Package. The linear statistical model assumed for the ANOVA was as follows:

$$Y_{ij} = U + t_i + r_j + e_{ij}$$

- Y_{ij} = Effect of the i th treatment in the j th replication.
 U = Overall mean performance of all treatments.
 t_i = Effect of the i th treatment (1,2,3---6).
 r_j = Effect of the j th replication (1,2,3).
 e_{ij} = Residual error as a result of the i th treatment in the j th replication.

RESULTS AND DISCUSSION

Results from the analysis of variance (Table 1) for the seven parameters measured showed that the mean square values for number of seed set/time and weight 30 F_1 seeds, showed highly significant variation for the different hours of pollination after emasculation of female flowers. Other parameters however, except percent germination and days to 95% maturity showed no significant variation in their mean square values while results from the mean performance in Table 2 indicated that in terms of number of seed set/time, crosses carried out 48 h after preparation

of the female flower out- performed all others, having scored the highest mean; crosses of 48 h after preparation of the female flower was closely followed by crosses conducted 27 and 52 h after preparation of the female flowers in performance, respectively. While the same crosses conducted 48 h after emasculation scored the highest mean in terms of weight or 30 F_1 seeds and vigour score, crosses of 24 h after emasculation had the highest viability and were closely followed by crosses performed at 31 h after emasculation and those of 48 h, respectively. While in terms of yield/plot, these were closely followed by those of 27 h after emasculation, those of 24 h after emasculation and 48 h after emasculation, respectively. Those crosses performed 54 h after emasculation however, not only have the poorest yield per plot, they took longer days to 50% flowing and also had poor seed weight. Table 2 showed appreciable level of significance for most parameters measured. The number of seed set/time varies significantly with the different timings, with those set 48 h after pollination, resulting in higher seed sets/time, similar observations were made by Leland (1985), where he observed that crosses performed within 48-52 h after emasculation were highly receptive and set more seeds. However, where crosses are delayed further, less success is recorded and where at all this success is recorded the seeds set are usually non viable. This is because the flowers are usually more receptive within the first three days of emasculation, although receptivity continues up to about 7 days after (Leland, 1985). Further, works by Espinoza and Quarin (2000) showed that more and normal seed are set by females pollinated 0-3 days after emasculation. Findings of the study also showed that the qualities displayed could be inherited among generations depending on the breeding objectives.

Table 1: Mean square values for the seven characters studied

Source of variation	df	Number of seed set/time	Weight of 30 F_1 seeds	Percentage germination of F_1 seeds	Days to 50% flowering	Days to 95% maturity	Yield per plant	Vigor score
Replication	2	15.16	0.0016	40.22	6.72	0.5	69.41	4.38
Timings(hrs)	5	162.90**	0.0784**	59.38*	1.55 ^{ns}	6.53*	86.86 ^{ns}	1.52 ^{ns}
Error	10	16.36	0.0063	17.55	3.45	2.03	38.33	0.58

** Highly significant ($p = 0.01$), * Significant ($p = 0.05$), ns = not significant

Table 2: Mean performances for the seven characters measured on the sorghum cultivars

Timing (h)	No. of seed set/time	Weight of 30 F_1 seed	Percentage germination (Viability)	Vigor scores	Days to 50% flowering	Days to 95% maturity	Yield per plant
24 h after preparation of female flower	10.00 ^{bc}	0.80 ^c	89.7 ^a	3.67 ^{ab}	37.67 ^a	82.00 ^f	81.87 ^{ab}
27 h after preparation of female flower	15.66 ^b	0.97 ^{ab}	85.6 ^{ab}	4.00 ^{ab}	37.33 ^a	86.00 ^a	82.47 ^a
30 h after preparation of female flower	2.67 ^c	0.83 ^{bc}	88.00 ^a	2.67 ^b	36.67 ^a	84.67 ^{abc}	85.83 ^a
48 h after preparation of female flower	24.00 ^a	1.06 ^a	83.33 ^{ab}	4.33 ^a	37.33 ^a	85.00 ^{ab}	81.83 ^{ab}
51 h after preparation of female flower	16.00 ^b	0.70 ^{cd}	79.66 ^b	3.00 ^{ab}	36.67 ^a	83.00 ^{abc}	80.47 ^{ab}
54 h after preparation of female flower	8.67 ^{bc}	0.63 ^d	78.00 ^b	2.67 ^b	35.67 ^a	83.00 ^{bc}	70.06 ^b

Means followed by the same letters do not differ significantly from each other according to Duncan Multiple Range Test (DMRT)

CONCLUSION

From the result obtained it was concluded that:

- The right time for pollination of sorghum in Yola environment is within 27-48 h for viable seed set.
- Seed test reveals that seeds obtained from crosses of 48 h after emasculation displayed more excellent results indicating that, this is the best time for the pollination of sorghum in Yola environment.

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