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Short Communucation

Interrelationships of seed reserve utilization components in *desi* cotton (*Gossypium arboreum*)

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Seedling growth is considered as a product of two components, namely, amount of seed reserve mobilized or seed reserve depleted (SRD) and conversion efficiency of mobilized seed reserve to seedling tissue or seed reserve utilization efficiency (mg seedling dry weight /mg seed reserve depleted). Studies on genetic variation and relationships among seed reserve and other standard seedling vigor traits such as seedling dry weight, rate/speed of germination, germination uniformity etc. in a few major crops [1, 2] indicated that utilization efficiency of seed reserve is a trait independent of the standard seedling vigour traits. Among the seed reserve parameters, total reserve depletion as well as reserve depleted per gm seed have been reported to decrease under moisture and salinity stress but seed reserve utilization efficiency was unaffected and the trait has been observed to be under genetic control [3, 4].

Gossypium arboreum genotypes of cotton commonly called as *desi* cotton of Indian origin are known to emerge earlier and to be more drought tolerant than to *G. hirsutum* (upland cotton). Baring a few studies on genetic variability and combining ability analysis of seed quality traits [5, 6] there are no studies reported on the role of reserve utilization/conversion for seedling emergence in cotton. Therefore, a study on reserve use/ conversion, for seedling emergence in cotton was conducted with seven released varieties of *G. arboreum viz*., AKA 7, AKA 8401, DLSA 17, G-Cot 19, PA 255, PA 402 and Veena. “Breeder seed” of above varieties were used in the study. The seeds had a moisture content of about 6-8%. The seeds were kept for germination following ISTA method [7]. The normal seedlings were counted after seven days of germination, before unfolding of cotyledon into normal leaves to ensure no photosynthesis occur. The seedlings were measured for shoot and root lengths and dried at 70°C overnight (complete drying till seedling tissue become brittle) to obtain seedling dry weight. The respective seed hulls of each seedling was also collected and kept for drying. Seed Reserve Depletion (initial seed weight - seed hull weight), Seed Reserve Depletion ratio (seed reserve depletion / initial seed weight), Seed Reserve Utilization Efficiency (seedling dry weight / Seed Reserve Depletion) and amount of seed reserve respired [Initial seed weight - (seedling dry weight + seed hull weight)] were estimated. Mean seedling dry weight was determined from a pool of 10 normal seedlings.

The genotypes varied significantly for all traits under study (Table 1) between two variables/traits. The correlation co-efficients among nine characters are presented in Table 2. The normal germination percentage showed significant positive association with seed reserve depletion rate (r = 0.861) and seed material respired (r = 0.95) but showed significant negative association with traits such as seedling dry weight (r = –0.987), seed reserve utilization efficiency (r = –0.99) and mean shoot length (r = –0.979) which is also in full agreement with earlier findings in other crops [8, 9]. Significant positive correlation of seedling dry weight with seed reserve utilization efficiency (r = 0.879) and shoot-root ratio (r = 0.923) but negative correlation of seedling dry weight with seed reserve depletion rate and amount of reserve respired suggest that substrate depletion and respiration was not linked to building any useful plant part as was observed in sorghum [10]. Instead significant positive correlation of seed reserve utilization efficiency with mean shoot length (r = 0.881)

Table 1. Variability for nine traits studied on seven *G. arboreum* genotypes

Traits\	Germination %	Seedling dry wt. (g of 10 seedlings)	Seed res. depletion (g of 10 seedlings)	Seed res. depletion in rate	Reserve utilization efficienty	Respira-tion	Mean shoot length (cm)	Mean root length (cm)	Shoot root ratio
Aka 7	89(70.82)	0.226	0.75	0.61	0.682	0.24	6.25	11.65	0.535
Aka 8401	92(75.93	0.262	0.967	0.67	0.61	0.385	5.9	11.45	0.512
DLSA 17	86.5(69.13)	0.262	0.795	0.585	0.74	0.205	8.575	13.925	0.620
GCot 19	72(59.52)	0.355	0.632	0.587	0.922	0.062	8.625	12.7	0.68
PA 255	89(72.13)	0.257	0.892	0.645	0.65	0.315	6.725	12.075	0.555
PA 402	99(86.44)	0.26	1.0025	0.645	0.64	0.36	6.275	11	0.568
Veena	94(77.71)	0.247	0.947	0.65	0.625	0.352	6.175	11.675	0.524
Mean	88.78(73.10)	0.247	0.855	0.627	0.695	0.274	6.932	12.068	0.571
SEd	6.138	0.006	0.0613	0.018	0.0293	0.036	0.255	0.610	0.0345
CD(.05)	12.766	0.012	0.127	0.037	0.0609	0.076	0.531	1.269	0.072
CD(.01)	17.382	0.017	0.173	0.051	0.083	0.103	0.724	1.728	0.098
CV%	11.880	3.13	10.13	4.02	5.96	18.9	5.22	7.15	8.57

Values in parenthesis are angular transformed values

Table 2. Genotypic correlation coefficients among seed vigor and reserve traits in seven *Gossypium arboreum* genotypes

Trait	Seedling dry weight	Seedling reserve depletion	Seed reserve depletion rate	Seed reserve utilization efficiency	Seed reserve respired	Mean shoot length (cm)	Mean root length (cm)	Shoot root ratio
Normal germination percentage	-0.987**	1.00	0.861*	-0.991**	0.95**	-0.979**	-0.86	-0.491
Seedling dry weight (g)	-0.618	-0.474	0.879**	- 0.742	0. 703	0. 377	0. 923**	
Seed reserve depletion (g)	0.901**	-0.911**	0. 979 **	- 0. 801*	- 0. 696	- 0. 858		
Seed reserve depletion rate (g g^{-1})	0.823*	0.924**	-0.929**	-0.875	-0.947**			
Seed res. utilization efficiency (g g^{-1})	-0.976**	0.881**	0.636	0.940**				
Seed reserve respired (g)	- 0.895**	- 0.729	- 0.996**					
Mean shoot length (cm)	0.973**	0.992**						
Mean root length (cm)	0.933**							

Significant at 5% and 1% probability levels, respectively

as well as significant positive correlation of mean shoot length with mean root length (r = 0.973) and shoot-root ratio (r = 0.002) has resulted in higher seedling dry weight in these genotypes. Seedling dry weight and seed reserve utilization efficiency also showed significant and positive correlation with shoot-root ratio (r = 0.923 & r = 0.940 respectively) as has been earlier reported in wheat [11, 12]. Positive correlation of seedling dry weight with seed reserve utilization efficiency but negative association of seedling dry weight with seed reserve depletion and rate of reserve depletion explains that higher amount of seed reserve depletion or seed reserve depletion rate are not the only deciding factors for better seedling growth in cotton. Seed reserve depletion and seed reserve depletion rate showed significant positive association (r = 0.901). However, significant negative association observed for seed reserve depletion and seed reserve depletion rate with seed reserve utilization efficiency (r = –0.911 & r = –0.823 respectively) makes it difficult to select for and improve all three traits together in evolving superior genotypes with good emergence potential. It has been suggested that seeds mobilizing a greater amount of their reserves tend to effectively utilize a smaller proportion of their reserves [13]. High seed reserve utilization efficiency assist seedlings in better emergence and extended field stress tolerance compared to low reserve utilization efficiency. This is because genotypes with low reserve utilization efficiency will have higher seed reserve depletion resulting in high solute leakage and associated microbial growth [11]. High respiration generating more heat is another factor creating suitable ambience for microbes, which showed positive association with seed reserve depletion and negative association with seed reserve utilization efficiency in the present study. It is thus concluded that higher reserve utilization efficiency and low reserve depletion in *arboreum* genotypes help them in early emergence in the field and enable them to escape the moisture stress that often occur during germination under rainfed cultivation.

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