

## STUDIES ON SOIL MOISTURE REGIMES DURING CSH-5 HYBRID SEED PRODUCTION - SEED GERMINATION, VIGOUR AND STORABILITY\*

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Studies on the influence of soil moisture monitored through IW/CPE (Irrigation Water/Cumulative Pan Evaporation) revealed that germination did not vary due to irrigation treatments. However, seed quality as estimated through seed weight, protein content, dry weight of seedling, vigour index, germination after soaking in  $\text{NH}_4\text{Cl}$  solution and dehydrogenase enzyme activity was maximum in plots receiving irrigation whenever, the ratio reached a value of 0.7.

Soil moisture plays an important role on quality (Austin, 1972). Chotena *et al.* (1980) in maize studied the effects of irrigation levels on seed quality. In sorghum, no such study has been reported. Hence, investigations were initiated to know the effect of soil moisture regimes on seed quality during CSH-5 hybrid seed production.

### MATERIALS AND METHODS

A field trial adopting randomized block design with five replications was laid out during the winter season of 1980 at the Agricultural Research Station, Bhavanisagar. The mother plant (ms 2077A) was given four irrigation treatments based on Irrigation Water/Cumulative Pan Evaporation ratios namely, 1.1 ( $I_1$ ), 0.9 ( $I_2$ ), 0.7 ( $I_3$ ) and 0.5 ( $I_4$ ). The male line (CS 3541) was sown 7, 10, 13 and 16 days after sowing of the female with one row at each time. Staggering was followed in order to ensure uninterrupted pollen supply,

After harvesting, threshing and cleaning, the hybrid seeds were graded using hand wire mesh sieves having 6 x 6, 7 x 7 and 8 x 8 square perforations per square inch. Data on (i) thousand seed weight, (ii) percentage germination, (iii) dry weight of ten normal seedlings, (iv) vigour index (Abdul-Baki and Anderson, 1973), (v) germination after accelerated ageing (Delouche and Baskin, 1973), (vi) germination after soaking in ammonium chloride solution (Abdullahi and Vanderlip, 1972), (vii) dehydrogenase enzyme activity (Kittock and Law, 1968) and (viii) protein content (Humphries, 1956) were recorded for 6 x 6 ( $G_1$ ) and 7 x 7 ( $G_2$ ) graded seeds.

### RESULTS AND DISCUSSION

In plants irrigated whenever the IW/CPE ratio reached 0.7 and 0.9, the seed weight was higher than in those irrigated either at higher or

\* Part of the Ph. D. Thesis approved by the Tamilnadu Agricultural University, Coimbatore.

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lower frequency (Table 1), Campbell *et al.* (1977) in wheat reported increased seed weight with more moisture. However, El-Sharkawy *et al.* (1977) in wheat obtained increased seed weight under water stress conditions.

The different size grades of seeds obtained from irrigation treatments did not show significant variations in germination. Chotena *et al.* (1980) in maize reported similar results. Reduced seed germination due to stress applied to mother plant has been reported in groundnut (Pallas *et al.*, 1977).

Seed harvested from plants receiving irrigations at IW/CPE ratio of 0.7 recorded maximum seed vigour, as evidenced from dry weight of seedlings, vigour index, germination after soaking in  $\text{NH}_4\text{Cl}$  solution and dehydrogenase enzyme activity (Table 2 and 3). Further, it was in this treatment that thousand seed weight and seed protein content were the highest. Protein content and vigour are positively correlated. Reduced concentration of assimilates and lessened efficiency of enzymes as was noted from dehydrogenase activity under excessive as well as insufficient moisture may be the probable reason for reduced vigour. Water stress reduced the vigour in maize (El-Forgany and Makus, 1979), while heavy irrigation and watering had reduced seed vigour in onion (Brown, *et al.*, 1977).

The protein content was higher in seeds collected from 0.7 and 0.9 ratio treatments than in others (Table 3).

Decrease in seed protein content due to increase in soil moisture and *vice versa* has been reported in wheat (Singh, *et al.*, 1979). Austin (1972) wondered whether the primary effect was on mineral absorption, by roots, or on their transfer from the plant to the seed or on the rate or extent of "filling up" of grain with carbohydrates and the concomitant dilution of the basic cell constituents. Leaching out of nitrogen under excessive irrigation could be one of the potential reasons (Stone and Tucker, 1969). Grain yield and protein content are negatively correlated. The higher yield obtained in 1.1 ratio treatment (Krishnasamy and Ramasamy, 1984) than in others might have diluted the protein per cell. At the same time, under the lowest moisture regime also, the protein content was low. According to Fisher and Hagan (1965), under Water stress conditions, proteolysis increases in the vegetative parts and on translocation of the resulting compounds to the developing grains, increased protein content would result. This could be possible only when stress occurred at a time when plants had already grown and accumulated good amount of protein in the leaves and stems. But in the present study, the treatment was effective from 25 days onwards and so the stress to the plants started practically from the early growth period which might have reduced the photosynthetic surface through leaf area reduction and photosynthetic efficiency by stomatal closure leading to poor accumulation of assimilates (Arnon, 1975).

Table 1. Thousand seed weight and germination in the size grades of CSH 5 hybrid seed as influenced by moisture regimes.

	Thousand seed weight (g)			Germination (Angular values of percentages)		
	6 x 6	7 x 7	Mean	6 x 6	7 x 7	Mean
I	32.31	23.50	27.40	60.0	58.5	59.4
I <sub>s</sub>	32.46	24.72	28.59	62.0	61.7	61.9
I <sub>2</sub>	32.98	24.43	28.70	61.4	62.8	62.1
I <sub>4</sub>	32.82	24.40	28.61	63.5	60.0	61.8
Mean	32.39	24.26	—	61.8	60.8	—
CD (P = 0.05)						
I	0.177					
G	0.125					
IG	0.250					

Table 2. Dry weight of seedlings, vigour index and germination after soaking in Ammonium chloride solution in the size grades of CSH 5 hybrid seed as influenced by moisture regime

	Dry weight (mg)			Vigour index			Germination after ammonium chloride soak (Angular values or percentages)		
	6 x 6	7 x 7	Mean	6 x 6	7 x 7	Mean	6 x 6	7 x 7	Mean
I <sub>1</sub>	96.5	81.0	88.8	2032	1627	1854	52.0	51.1	51.5
I <sub>2</sub>	96.8	77.8	87.3	2117	1972	2044	53.6	51.7	52.6
I <sub>3</sub>	109.5	96.0	102.8	2233	2269	2251	58.1	57.8	57.9
I <sub>4</sub>	96.3	82.2	89.5	2057	1860	1959	50.5	49.8	50.1
Mean	99.8	84.4	—	2112	1932	—	53.5	52.6	—
CD (P = 0.05)									
I	11.2			254			2.4		
G	7.9			180			NS		
IG	NS			NS			NS		

Table 3. Germination after accelerated ageing, dehydrogenase enzyme activity and protein content in the size grades of CSH 5 hybrid seed as influenced by moisture regimes

	Germination after accelerated ageing (Angular values of percentages)			Dehydrogenase enzyme activity (O. D)			Protein content (per cent)		
	6x6	7x7	Mean	6x6	7x7	Mean	6x6	7x7	Mean
I <sub>1</sub>	49.3	47.9	48.6	0.375	0.355	0.365	11.38	10.45	10.91
I <sub>2</sub>	50.8	49.3	50.1	0.385	0.338	0.361	12.26	10.44	11.35
I <sub>3</sub>	55.0	54.1	54.5	0.403	0.388	0.395	12.14	10.57	11.36
I <sub>4</sub>	15.6	45.6	45.6	0.378	0.313	0.345	9.50	8.98	9.24
Mean	50.2	49.2	—	0.385	0.345	—	11.32	10.11	—
CD (P=0.05)									
I	2.7			0.024			0.67		
G	NS			0.017			0.47		
IG	NS			NS			NS		

A combined study on the interaction between fertilizer doses and irrigation schedules would be useful to evolve better methods for increasing the seed yield without affecting its quality.

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