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Effects of Pre-seeding Treatments with Certain Chemicals Including Plant Growth Regulators on Growth and Development of Hybrid Bajra-115 (*Pennisetum typhoides* S & H)*

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ABSTRACT

Germination, seedling growth (Experiment 1, monsoon, 1966 and summer, 1967) and growth responses (Experiments 2 and 3) of hybrid bajra-115 grown in petridishes and pots, respectively were investigated with seeds soaked in Ascorbic acid (AA) (25,50,100 and 200 mg/l), Gibberellic acid (GA_3) (100,200,400 and 800 mg/l), Potassium nitrate (0·25, 0·50, 1·00 and 2·00%) and Thiourea (25,50,100 and 200 mg/l). In the monsoon trial of Experiment 1 where the seed appeared to be dormant, the treatments with AA,GA_3 and Thiourea (except 25 mg/l) accelerated germination while final germination was improved by Thiourea at 100 mg/l only. The effect of these growth regulators was not apparent on non-dormant seed in summer trial. Potassium nitrate at 2% not only delayed, but also reduced final germination percentage in both the trials. Of these chemicals, only GA_3 promoted plumule elongation significantly.

Ascrobic acid tended to increase grain yield at 25 mg/l concentration. GA_3 increased the plant height and reduced the leaf and tiller numbers at 800 mg/l in Experiment 3. Potassium nitrate (2%) and Thiourea (100 mg/l) increased straw yield (Experiment 3) and the effects of the latter are possibly, through an increase in leaf and tiller numbers. *(Received on October 29, '77)*

INTRODUCTION

PERHAPS the most striking effects that have been given attention in the regulation of growth and development of plants during the past few years, have been those brought about by the application of some chemicals, which have proved to be of immense value as regulators of various growth and developmental processes in plants. Use of soaked and dried seeds has been suggested as one of the methods in increasing the yield of crops grown under unfavourable conditions like drought, through hastening of germination and improving resistance to some unfavourable environmental factors (Dawson, 1965). The information on the effects of soaking and drying of bajra seeds in some of the growth regulators like GA_3 and Thiourea, vitamin C; and nutrients like Potassium nitrate, on growth and development of bajra has been inadequate and so it was considered that the effects on germination, growth and yield of bajra should be studied in greater detail in order to ellucidate their role in these developmental processes.

MATERIAL AND METHODS

Pearl millet (*Pennisetum typhoides* S & H) was selected for this study as it is

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one of the important cereal crops in India, particularly in Gujarat, and is grown for its nutritive grain and forage. Hybrid bajra-115 seeds seem to have some dormancy period and information on the effects of Ascorbic acid, Gibberellic acid, Thiourea and Potassium nitrate on germination, growth and development is not available.

The procedure followed by Chinoy (1967) for presoaking with *AA* was adopted here with slight modification. The treatments consisted of presoaking in water, *AA* (25,50,100 and 200 mg/l), GA_3 (100,200,400 and 800 mg/l), Potassium nitrate (0·25, 0·50, 1·00 and 2·00%) and Thiourea (25, 50, 100 and 200 mg/l). Seeds without any pre-treatment served as one control.

Bajra seeds were treated with one of the above solutions at the rate of 400 ml per kilogram of seeds. The seed was continuously stirred with a glass rod in a petridish for nearly an hour such that all the liquid was absorbed by the seed. The treatment was started after sun set. After the seeds have absorbed all the liquid they were covered with a wet cloth and kept in the moist condition for about 4 hrs. They were stirred frequently at intervals of 15 minutes so as to keep them at a uniform moisture level. At the end of 4 hrs period, the seeds were spread out in a thin layer of canvas in a cool shady place for nearly 24 hrs to dry them. The soaking and drying procedure was repeated for the second and third time at 24 hrs interval after which they were ready for germination trials in petridishes (Experiment 1) and for studies on growth and yield in pots (Experiments 2 and 3).

Experiment 1: The germination trial was conducted in petridishes with 100 of the seeds soaked in the above solutions. There were four replications. Water was added to the blotting papers as and when required as the medium for germination in all cases. This experiment was conducted in July, 1966 (monsoon) and March, 1967 (summer). Germination counts were taken for every 12 or 24 hrs till the germination was complete. In addition, observations on growth of seedlings were also taken in summer trial.

Experiment 2: This experiment was conducted in pots during monsoon, 1966 (July to October). Well prepared and manured *goradu* soil was filled in China clay pots of 23×23 cm size in replications 1 & 2, and in pots of 14×17 cm size in replications 3 & 4. Four pretreated bajra seeds were sown in big pots and 2 in small pots. After germination these were thinned to 2 in replications 1 & 2 and to 1, in 3 & 4. All the plants were harvested at maturity and observations on plant height, grain and straw yields were recorded. The leaf and tiller number were recorded at 40 and 50 days, respectively.

Experiment 3: The previous experiment was repeated during summer, 1967 (March-June) with the small size pots and one plant retained in each. Rest of the details were as given in Experiment 1.

TABLE 1

Germination, growth and yield responses of bajra as affected by soaking and drying treatments with certain chemicals.

Treatment	*Experiment No. 1 (Summer trial)*		2	3	2	3	2	3	2	3	2	3
	% germination		*Plumule length*	*Plant Height*		*Leaf number*		*Tiller number*		*Straw weight*		*Grain weight*	
	1 day	*5 days*	*(cm)*	*(cm)*						*(gm)*		*(gm)*	
1 No soaking	95·3	96·8	1·52	92·4	45·6	33·4	42·5	4·1	8·3	14·1	16·5	6·7	3·7
2 Water ,,	95·0	96·8	1·79	97·3	50·6	31·8	39·8	3·9	7·5	12·7	16·5	6·6	3·8
3 AA 25 mg/l	95·8	98·0	1·55	91·9	57·3	39·5	41·8	5·0	7·3	20·0	19·0	8·1	5·9
4 ,, 50 ,,	90·8	97·0	1·62	92·5	57·8	43·6	42·5	5·8	6·8	17·3	16·8	5·2	3·8
5 ,, 100 ,,	90·0	97·0	1·65	85·5	54·3	41·1	46·0	5·9	8·0	17·4	16·0	6·9	3·8
6 ,, 200 ,,	92·0	97·0	1·80	97·1	56·3	32·8	41·5	4·1	7·8	14·5	18·1	6·7	2·7
7 GA_3 100 mg/l	94·5	96·3	2·37	92·5	45·9	35·0	40·0	4·0	7·5	11·5	13·6	6·7	2·4
8 ,, 200 ,,	95·5	97·5	2·56	103·9	62·0	38·8	36·5	4·4	6·0	15·5	15·1	6·9	3·8
9 ,, 400 ,,	95·5	98·0	2·75	106·8	62·3	39·3	33·5	4·4	5·8	16·8	19·3	7·4	3·3
10 ,, 800 ,,	95·8	98·3	3·12	106·3	64·4	34·6	28·5	4·0	4·3	20·5	15·0	8·5	3·2
11 KNO_3 0·25%	95·0	97·0	2·11	80·3	52·9	31·9	37·8	4·1	6·5	15·6	17·0	7·0	4·0
12 ,, 0·50%	86·5	90·8	1·99	96·0	61·0	33·8	34·8	4·0	6·0	12·6	17·0	7·1	4·1
13 ,, 1·00%	67·0	74·0	1·95	95·9	57·8	35·3	35·8	4·8	6·3	15·1	19·3	7·8	2·4
14 ,, 2·00%	43·8	52·0	1·73	—	75·8	—	38·8	—	7·0	—	21·3	—	1·7
15 Thiourea 25 mg/l	93·0	96·0	1·61	81·5	48·1	33·4	43·5	4·0	6·8	13·6	16·6	7·4	2·2
16 ,, 50 ,,	94·0	97·3	1·60	97·1	53·0	36·0	38·8	4·8	7·0	16·4	17·1	7·4	2·1
17 ,, 100 ,,	93·0	98·0	1·50	98·5	59·6	36·8	54·0	5·6	12·0	17·8	26·1	5·6	1·8
18 ,, 200 ,,	92·8	97·0	1·58	94·1	46·6	32·4	37·8	4·1	6·3	13·5	18·7	8·7	2·8
CD (0·05)	4·7	3·6	0·62	15·2	15·6	NS	9·4	NS	3·0	NS	4·1	NS	NS

NS = Non significant

RESULTS AND DISCUSSION

Experiment 1: The data of the germination trials for monsoon are presented graphically in Figs. 1 to 4 and for summer (at 1 and 5 days) in Table 1.

In the monsoon trial where the seed appeared to be dormant, there was significant acceleration in germination at 24 hrs by *AA* 25 and 200 mg/l while at 2 days all the *AA* treatments hastened germination (Fig. 1). However, the final germination was not improved by *AA* in both the trials. Havas (1935) observed that vitamin C had no stimulatory effect on germination of seeds and at higher concentrations even inhibited it. GA_3 and Thiourea in general accelerated germination at both one and two days in monsoon (Fig. 2 and 4). The effects of GA_3 in hastening germination are in agreement with those of other workers (Allan *et al.*, 1961; Pauli and Stickler, 1961 and Chacko and Singh, 1966). The final germination was improved only by Thiourea at 100 mg/l. The beneficial effects of Thiourea on seed germination were also observed by Poljakoff-Mayber and Mayer (1960) and Frankland and Wareing (1966). In the summer trial where the seed seem to be non-dormant, none of the above chemicals was effective in hastening germination (Table 1). Potassium nitrate exerted an inhibitory effect on seed germination at 1 and 2 days in monsoon (2%) (Fig. 3) and summer (0·5% and above), and finally at the higher concentrations in both the seasons. This could be due to the inhibitory effects of nitrate on seed germination (Lugo Lugo, 1955; Mikkelsen and Sinah 1961).

Thus it is apparent from the above findings that the chemicals like *AA*, GA_3 and Thiourea (except 25 mg/l) can be employed for taking advantage of their beneficial effects in enhancing the germination of bajra seed, slow in germination. It is also clear that Potassium nitrate at the highest concentration (2%) used is toxic to germination.

GA_3 at all the concentrations increased the length of plumule (Table 1), while the other chemicals were not effective in altering it.

Experiments 2 and 3: The data are presented in Table 1. Since Potassium nitrate at 2% concentration inhibited germination, the data for this treatment are not available in Experiment 2.

While *AA*, Thiourea and Potassium nitrate (except 2% in Expt. 3) were not consistent in their effects, GA_3 at higher concentrations significantly increased the height over control in both seasons (Table 1). This effect of GA_3 is in conformity with the observations of Sandhu and Hussain (1961) and Chacko and Singh (1966). It appears that bajra is less sensitive in its response in height to *AA* and this is in contrast to the findings of Chinoy *et al.*, (1957) who observed a stimulatory effect of *AA* on *Trigonella foenum* and *Brassica chinensis*. The increase in height at 2% Potassium nitrate in Experiment 3 could be related to the observed effects in increasing the number of internodes and other formative effects

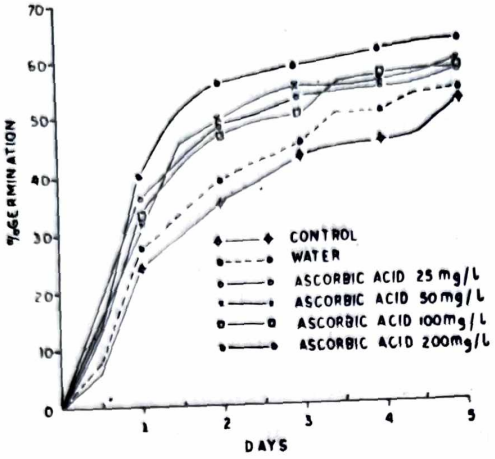

Fig. 1. Germination of bajra as influenced by Ascorbic acid (Experiment 1, monsoon trial)

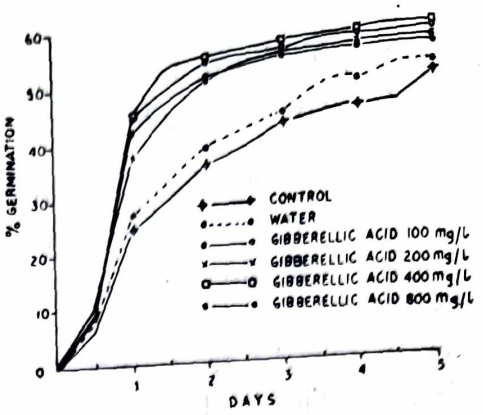

Fig. 2. Germination of bajra as influenced by Gibberellic acid (Experiment 1, monsoon trial)

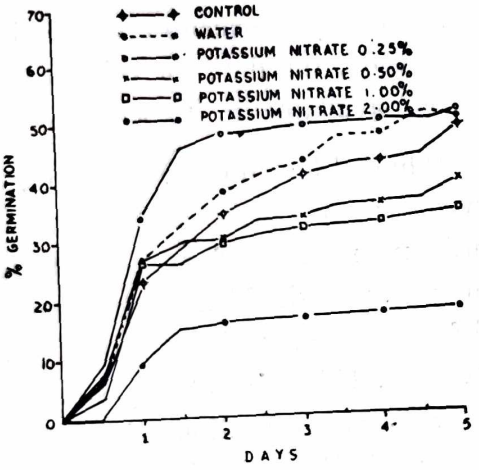

Fig. 3. Germination of bajra as influenced by Potassium nitrate (Experiment 1, monsoon trial)

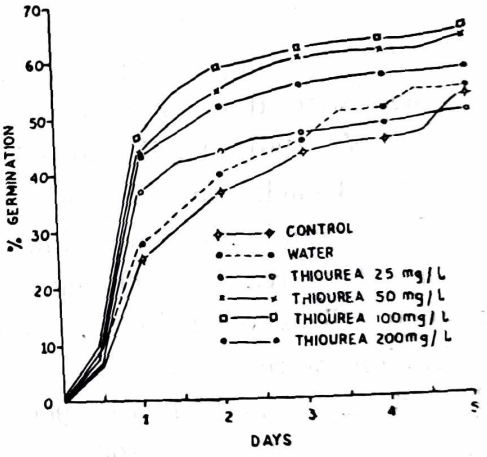

Fig. 4. Germination of bajra as influenced by Thiourea (Experiment 1, monsoon trial)

of nitrogen. *AA* and Potassium nitrate did not show any significant effects on leaf and tiller numbers (Table 1). However, these were significantly increased by Thiourea, 100 mg/l, in summer crop and reduced by GA_3, 800 mg/l.

AA at 25 mg/l tended to increase the straw weight in both the seasons although the increases were not statistically significant. GA_3 was not effective in this respect (Table 1). Potassium nitrate at 2% concentration increased the straw weight. Thiourea 100 mg/l increased the yield of straw in Experiment 3 and a similar trend was seen in Experiment 2. The results of Cibes and Adsnar (1966), and Palladina and Pervova (1966) also show increase in vegetative growth of Yam and potato, respectively with pre-soaking treatment of Thiourea. *AA* 25 mg/l treatment tended to increase grain weight as compared to control (Table 1). However, the effect was not significant. Gutmane (1963), Chinoy (1967) recorded beneficial effects of treatment with *AA*. Other chemicals did not affect the grain yield markedly.

The results give some indication of the possible beneficial effects of soaking and drying of bajra seeds in Ascorbic acid, 25 mg/l, in increasing the grain production, since in both the seasons it tended to increase the grain yield. Similarly, Thiourea at 100 mg/l, seems worth trying for increasing the forage yield.

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