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Physiological Effects of Seed Treatments with GA on Seeding Growth Under Laboratory and Field Conditions in Jowar

Botany

KEYWORDS : seed germination, seedling growth, growth regulators, GA, Jowar

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ABSTRACT

Immersion of seeds in solutions containing PGRs has been suggested by various workers to enhance seed germination and emergence potential, under adverse growing or environmental conditions, or alternatively under satisfactory conditions using seeds of impaired germinating quality.

GA are used to increase alpha amylase activity in germinating Barley seeds . which is used for malt production in beer Industry. This hormone also stimulates hydrolysis and transport of stored food material from endosperm and cotyledons to the growing Root-Shoot axis specially in the cereals.

Interest in the use of growth regulators in crop production arises from the beliefs of plant physiologists that maximum levels of plant productivity GA promote seed germination .GA has several form .GA 10-1, GA 10-2, GA 10-3…..so on . All the Gibberellins are able to promote either stem elongation or cell division although their relative effectiveness may be different.

Studied for determining effect of different concentration of GA in Jowar on percentage germination and seedling growth in terms of shoot and root lengths and dry weight distribution. Under Laboratory and Field conditions.

INTRODUCTION

PGRs (GA3) have been found quite effective when incorporated in partially aged seeds of soybean, with mustard and black gram and green gram (Saxena 1989). Lint index, seed index, ginning %, boll numbers and weight of seed cotton per boll, PGR were increased in treated seeds. Pod numbers, pod weight per plant, yield of branches were higher in pretreated seeds of mustard. The number of pods per plant and 100 seed weight were higher in black gram and green gram. The cumulative effects of these treatments in increasing productivity of these crops were quite significant under field conditions (Saxena, 1989).

From the -foregoing review the impacts of seed pretreatments with GA . in improving yields in a variety of plants is apparent. PGRs are beneficial in increasing vegetative and reproductive growth under field conditions. Hence, it was thought worthwhile to investigate the effects of seed pretreatments with PGRs like GA, on Jowar crop recommended for intensive cultivation . The results obtained are discussed below.

MATERIALS AND METHODS

The seeds of Jowar (M-35-1. MSSC) were studied for their physiological performance under the effect of 10-4 to 10- 7 M concentration of gibberellic acid (GA)

The seeds were soaked in different concentrations of GA for the optimum periods was 5 hrs for Jowar. Two sets of experiments were laid : (I) laboratory studies and (II) field studies.

The results reported in Tables are means of at least three replications and were analyzed statistically.

Laboratory studies

In all these studies, uniformly selected seeds were germinated in sterilized petridishes lined with filter paper and treated with 8 ml DW. The seeds were also treated with mercuric chloride to avoid fungal contamination. The percent germination, lengths of shoot and root were measured after 5 days. The petridishes were kept at 28°C +- 20C and under normal light condition. Fresh and dry weight (mgm per organ) was recorded after drying the samples in an oven at 80°C.

(II) Field studies

Seeds of four seeds were pre-soaked for their optimum drying period. They were then air dried to bring to their initial weight. The pre-soaked and dried seeds were grown in rows made in field plots (30 m^2) for 30, 60 and 90 days. The following data were collected on the plants so cultivated (1) height, (2) leaf length, (3) leaf width, (4) leaf area, (5) leaf number, (6) tiller numbers, (7) stem dry weight, (8) root dry weight, (9) total plant weight.

OBSERVATION & OBSERVATION TABLE

Table 1. Effect of presoaking Jowar for 5 hours in different concentrations of GA on % germination and seedling growth.

Plant Growth Regulators (Hrs)	% Germination	ROOT			SHOOT			LEAF	
		LN	FW	DW	LN	FW	DW	FW	DW
GA 0	76	4.73	108	13	6.03	111	14	106	11
GA 10-4	100	10.17	116	17	6.80	114	18	109	14
GA 10-5	80	9.70	77	13	5.70	109	16	106	12
GA 10-6	63	7.70	110	12	5.50	108	15	104	10
GA 10-7	56	7.23	108	10	5.17	106	13	101	10
S.E. C.D. (P=0.05)	2.87 6.39	0.07 0.15	10.52 23.43	0.33 0.73	0.05 0.11	0.33 0.73	0.39 0.89	0.80 1.78	0.26 0.57

Table 2. Effect of presoaking of Jowar 5 hours in different concentration of GA after air drying on % germination and seedling growth.

Plant Growth Regulators (Hrs)	% Germination	ROOT			SHOOT			LEAF	
		LN	FW	DW	LN	FW	DW	FW	DW
GA 0	76	2.33	116	15	5.80	111	13	108	11
GA 10^{-4}	96	6.30	126	17	13.10	118	16	112	14
GA 10^{-5}	86	6.17	118	15	11.53	112	12	108	11
GA 10^{-6}	70	6.03	112	13	10.77	110	11	107	10
GA 10^{-7}	53	5.57	110	11	8.33	108	10	102	10
S.E. C.D. (P=0.05)	2.98 6.63	0.08 0.17	0.57 1.20	0.35 0.77	0.05 0.11	0.41 0.91	0.37 0.82	0.45 1.00	0.45 1.00

Table 3. Physiological performance of seedlings from presoaked (air dried) seeds of Jowar in GA (10^{-4} to 10^{-7}) under field condition at 30, 60, 90 days

Treat-ment	Plant Height	Leaf Length	Leaf Width	Leaf Area	Leaf No.	Tiller No.	Stem Dry wt.	Root Dry wt.	Total Plant wt.
30 days									
Con-trol	36.80	23.67	1.07	0.17	4	1	35.67	40.33	338
10^{-4}	42.37	32.33	2.07	0.22	6	3	44.67	58.00	408
10^{-5}	38.73	28.33	1.80	0.22	4	2	36.67	45.33	362
10^{-6}	34.77	23.00	1.43	0.21	3	2	38.00	39.00	341
10^{-7}	34.13	20.00	1.20	0.21	2	1	35.00	39.00	341
S.E. C.D.	3.52 7.10	0.017 0.06	0.5 2.18	0.72 1.98	0.01 0.08	0.61 0.95	0.42 0.01	0.46 1.02	0.39 0.86
60 days									
Con-trol	44.43	26.67	1.83	0.17	5	1	38.33	81.00	356
10^{-4}	84.77	32.67	2.60	0.22	8	3	48.00	92.67	432
10^{-5}	81.43	30.33	2.20	0.21	7	2	47.33	82.67	383
10^{-6}	75.27	26.00	1.97	0.21	6	2	40.67	85.67	363
10^{-7}	75.13	23.00	1.73	0.21	6	1	36.00	85.33	352
S.E. C.D.	2.51 5.59	0.03 0.06	0.38 0.84	0.63 1.40	0.04 0.08	0.42 0.93	0.42 0.93	0.47 1.04	0.55 1.22
90 days									
Con-trol	58.57	28.67	2.43	0.17	6	2	42.00	48.00	387
10^{-4}	119.0	33.33	3.27	0.23	9	4	56.67	65.33	594
10^{-5}	113.3	32.33	3.40	0.21	7	2	51.00	61.67	483
10^{-6}	112.7	30.67	3.37	0.21	6	2	50.33	60.00	425
10^{-7}	110.3	27.00	3.10	0.21	5	2	48.00	54.33	382
S.E. C.D.	2.42 5.39	0.08 0.17	0.75 1.67	0.40 0.89	0.05 0.11	0.59 1.31	0.60 0.13	0.44 0.98	0.34 0.75

RESULT AND DISCUSSION

Laboratory studies on Jowar seeds

The percent germination in Jowar seeds pre-soaked with PGRs ranged from 40 to 100% with best result obtained at 10^{-4} GA concentration (Table 1). With lower concentrations of PGRs the percent germination was found to be less than that for the control. The root length was found maximum in GA treated seeds. The root length (cms) ranged from 4.7 to 10.1, 4.1 to 10.6 and 4.2 to 4.6 with GA . The shoot length (cms) varied from 5.1 to 6. 8 with GA . The dry weight of roots after 5 days ranged from 10 to 17 and that of shoot from 10 to 18 with the GA; the best results were again seen at 10- 4 PGR concentration. The dry weight of the leaf was maximum with GA (10 to 14) (Table 1).

The results on air dried Jowar seeds are included in Table 2. The results were better with air dried seeds than with soaked seeds. Percent germination ranged from 53 to 97 with PGRs and from 53 to 76 in control. The root length was maximum with IAA whereas the shoot length with GA .The former ranged from 2.7 to 6.8 cms and latter from 3.7 to 13.1 cms . The lowest concentrations of PGRs often showed lesser seedling growth than in control. The dry weight of roots was maximum with shoot with GA. On the whole, the dry weights of roots and shoots varied within 10 and 17 mgm. As far as leaf dry weight is concerned the best result obtained as in the case of shoot and root, 10^{-4} concentration was the best.

Field studies on jowar seeds

Tables 3, include results obtained with GA on 30, 60 and 90 days old Jowar seedlings. As in the case of wheat the concentration of 10- 4 PGR gave most satisfactory results as far as plant height, leaf growth and dry weights of stem and root were concerned. Plant height reached (in cms) 42.3 with GA, in 30 days. The height of the plant reached 84.7, at 60 and 119 at 90 days with GA respectively. The height of the plant was almost double than wheat mainly because jowar possess C_4 pathway of photosynthesis. The same was true for leaf length which reached over 32 cms at 30 days, 34 cms at 60 days and 90 days with the GA PGRs. The difference in leaf width due to the GA PGRs was statistically insignificant. The leaf area ranged from 0.17 to 0.23 in all the treatments. The number of leaves was generally 4 to 8 at 30 and 60 days and 5 to 9 at 90 days. Tiller number ranged from 1 to 3 in majority of plants. At 30 days stem weight was maximum in GA treated plants. At 90 days dry weight of the stem was maximum with GA. The differences in dry weight yield of stems and roots with the GA PGRs were statistically insignificant at 90 days with the PGRS.

CONCLUSION

GA was largely responsible for elongation of shoot. GA stimulate extensive growth in intact plants. They enhance elongation of intact stems much more than that of excised stem segments

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