INFLUENCE OF SEED PRIMING ON FIELD PERFORMANCE IN SOYBEAN (*Glycine max* L. Merill.)

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ABSTRACT

Investigation was carried out in order to study the influence of seed priming on field performance in soybean (Glycine max L. Merill.) at Junagadh Agricultural University, Junagadh during kharif 2017. The experimental materials were evaluated following randomized block design (factorial) with three replications. The first factor comprises three genotypes (GJS-1, JS-20-29 and JS-335) and the second factor consists seed priming treatments (Control, Cow urine (100%), Cow urine (50%), KH_2PO_4 (2%), KH_2PO_4 (1%), KNO_3 (2%), KNO_3 (1%), $CaCl_2$ (2%), $CaCl_2$ (1%) and Neem leaf extract (50%)). Results showed that seeds of the genotype GJS-1 primed with $CaCl_2$ (2%) were earlier in days to 50 percent flowering and days to maturity with higher plant height and more number of branches per plant, number of pods per plant, number of seeds per plant, 100 seed weight (gm) and seed yield per plant (g), while lower seed yield and yield contributing character were recorded in seeds of genotype JS-20-29 primed with neem leaf extract (50 %).

KEY WORDS: Field performance, Priming, Soybean

INTRODUCTION

Soybean [*Glycine max* (L.) Merill] is one of the most important protein and oil seed crop throughout the world. Its oil is the largest component of the world's edible oils. The world production of edible oils consists of 30 per cent soybean. It is an ingredient of more than 50 per cent of the world's high protein meal. The native of soybean is Eastern Asia. Soybean was introduced to India during 1880. Soybean crop is known as "Golden Bean", "Miracle crop", "Wonder crop", and "Gold of Soil". Other than the whole phase, a lot of processed soya milk, soya flour, soya paneer and some fermented soya are its products. From nutritional point of view, soybean contains 43.2 per cent protein and 20.0 per cent edible oil. Soybean protein is also rich in valuable amino acid "lysine" (5 %), which is deficient in most of the cereals (Hammond *et al.,* 2005). Soybean protein composed of ten properly balanced amino acids. In addition, it is a source of vitamin–B complex, thiamin and riboflavin (Gopalan *et al*., 1971). Besides oil and high quality protein, soybean fixes atmospheric nitrogen in the soil at the rate of 150-165 kg/ha with the help of symbiotic bacteria (*Rhizobium japonicum*) present in the root nodules (Koutroubas *et al.,* 2008). Therefore, it has a unique importance as a

rotational crop in building up sustainable agriculture in cropping systems.

Priming in its traditional sense, soaking of seeds in water before sowing, has been the experience of farmers in India in an attempt to improve crop stand establishment but the practice was without the knowledge of the safe limit of soaking duration (Harris, 1996). Moreover, Harris *et al*. (1999), promoted a low cost, low risk technology called 'on-farm seed priming' that would be appropriate for all farmers, irrespective of their socioeconomic status. On-farm seed priming involves soaking the seed in water, surface drying and sowing the same day. The rationale is that sowing soaked seed decrease the time needed for germination and allow the seedling to escape deteriorating soil physical conditions. According to Khan (1992), osmotic conditioning in its modern sense, aims to reduce the time of seedling emergence, as well as synchronize and improve the germination percentage by subjecting the seeds to a certain period of imbibition using osmotic solutions. The seeds normally begin water uptake on contact with this solution and stop the process as soon as they become balanced with the water potential of the solution. The mechanism of seed drying after chemical priming is known as the hydration-dehydration process or dry back and is used to reduce the degree of moisture in seeds to levels compatible with storage and maintaining the beneficial effects of the treatment, without quality loss caused by rapid seed deterioration. Park *et al.* (1997) reported that the priming aged seeds of soybean resulted in good germination and stand.

MATERIALS AND METHODS

Hundred grams seeds of soybean seeds *cv*. GJS-1 (G_1), JS-20-29 (G_2) and JS-335 (G_3) were dipped in priming solution (Control (T_1), Cow urine (100%) (T_2), Cow urine (50%) (T_3), KH_2PO_4 (2%) (T_4), KH_2PO_4 (1%) (T_5), KNO_3 (2%) (T_6), KNO_3 (1%) (T_7), $CaCl_2$ (2%) (T_8), $CaCl_2$ (1%) (T_9) and Neem leaf extract (50%) (T_{10})) for 6 hours. Afterwards, primed seeds were allowed to dry back to their original moisture content under the shade and were evaluated in the field following Randomized Block Design (Factorial) for growth and yield contributing parameters viz., days to 50 per cent flowering, plant height (cm), number of branches per plant, days to maturity, number of pods per plant, number of seeds per pod, 100 seed weight (g) and seed yield per plant (g). The data obtained from field experiment conducted in FRBD was analyzed as per standard method suggested by Cochran and Cox (1957).

RESULTS AND DISCUSSION

Yield and yield contributing parameters assessed on the resultant seeds differed significantly due to the difference in genotypes. Significantly lesser number of days to 50 per cent flowering (41.17), highest plant height (42.45 cm), higher number of branches per plant (5.91), lesser number of days to maturity (84.86), higher number of pod per plant (44.65), higher number of seeds per pod (2.35), more 100 seed weight (13.70 g) and higher seed yield per plant (14.32 g) was recorded in GJS-3 genotype (G_1), while the maximum number of day to 50 per cent flowering (43.92), lowest plant height (36.45 cm), lesser number of branches per plant (4.88), maximum day to maturity (89.39), lesser number of pod per plant (37.69), lesser number of seeds per pod (2.12), lowest 100 seed weight (12.05 g) and lowest seed yield per plant (9.62 g) was recorded in seeds of genotype JS-20-29 (G_2) (Table 1 and 2).

The priming treatments had significant influence in the resultant seed across all the yield and yield contributing parameters tested (Table 1 and 2). Significantly minimum number of days to 50 per cent flowering (38.75), highest plant

height (45.10 cm), maximum number of branches per plant (7.10), minimum days to maturity (82.86), maximum number of pods per plant (49.67), maximum number of seeds per pod (2.71), maximum 100 seed weight (13.73 g) and maximum seed yield per plant (18.44 g) was recorded in treatment having seed primed with $CaCl_2$ (2%) (T_8), which was at par results with seed primed with KH_2PO_4 (2%) (T_4) in case of plant height (43.84 cm), number of branches per plant (6.89), days to maturity (83.75), number of pods per plant (2.48), 100 seed weight (13.53 g) and seed yield per plant (15.79 g); while lowest yield and yield contributing parameters were recorded in treatment having seed primed with neem leaf extract (50%) (T_{10}). Bhingarde *et al*. (2015) reported that the enhancement in plant height with $CaCl_2$ might be due to cell enlargement and increase in normal cell division. They also reported that more number of pods per plant might be due to calcium improves pod filling, which resulted in increase the number of well-filled pods and ultimately seed yield per plant. Sashidhar *et al.* (1977), Narayanswamy and Shambhulingappa (1998), Narayanareddy and Biradarpatil (2012), Chavan *et al.* (2014), Fatemeh *et al.* (2017) and Jadhav *et al.* (2017) reported similar beneficial results on yield and yield contributing parameter due to priming with calcium chloride.

The number of days to 50 per cent flowering, days to maturity, number of seeds per pod and 100-seed weight showed non-significant difference due to interaction of genotype and seed priming treatments. Significantly the highest plant height (48.71 cm), maximum number of branches per plant (7.98), maximum number of pods per plant (57.11) and maximum seed yield per plant (23.53 g) was recorded in G_1T_8; while the lowest plant height (30.68 cm), minimum number of branches per plant (3.83), minimum number of pods per plant (29.88) and lowest seed yield per plant (11.30 g) was recorded in G_2T_{10}.

CONCLUSION

From the results, it can be concluded that sowing of soybean seeds after priming $CaCl_2$ (2%) was beneficial, as it resulted in to earlier in flowering and days to maturity with higher plant height and more number of branches per plant, number of pods per plant, number of seeds per plant, 100 seed weight (gm) and seed yield per plant (g).

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Table 1: Effect of seed priming treatments to different genotypes and their interactions on days to 50 per cent flowering, plant height (cm), number of branches per plant and days to maturity in soybean

Treatments	Days to 50 % Flowering	Plant Height (cm)	No. of Branches/ Plant	Days to Maturity
Genotype (G)				
G_1 - GJS-3	**41.17**	**42.45**	**5.91**	**84.86**
G_2 - JS-20-29	**43.92**	**36.45**	**4.88**	**89.39**
G_3 - JS-335	42.01	39.45	5.35	87.83
S.Em±	0.61	0.44	0.09	1.15
CD at 5%	1.73	1.25	0.26	3.25
Priming Treatments (T)				
T_1 - Control	43.88	37.97	4.63	89.97
T_2 - Cow urine (100%)	45.20	33.57	4.18	91.64
T_3 - Cow urine (50%)	44.19	36.17	4.40	90.53
T_4 - KH_2PO_4 (2%)	40.08	43.84	6.89	83.75
T_5 - KH_2PO_4 (1%)	41.97	40.97	5.40	85.53
T_6 - KNO_3 (2%)	40.53	42.71	6.37	84.19
T_7 - KNO_3 (1%)	41.97	39.84	5.04	86.30
T_8 - $CaCl_2$ (2%)	**38.75**	**45.10**	**7.10**	**82.86**
T_9 - $CaCl_2$ (1%)	40.53	42.01	5.83	84.97
T_{10} - Neem leaf extract (50%)	**46.56**	**32.32**	**3.94**	**93.86**
S.Em±	1.12	0.81	0.17	2.09
CD at 5%	3.16	2.29	0.47	5.92
Interaction (G × T)				
$G_1 \times T_1$	41.64	39.52	5.02	87.63
$G_1 \times T_2$	43.30	35.40	4.56	90.30
$G_1 \times T_3$	42.64	36.87	4.75	89.30
$G_1 \times T_4$	38.64	48.06	7.58	80.96
$G_1 \times T_5$	41.64	45.14	6.06	82.30
$G_1 \times T_6$	39.64	46.86	6.89	81.30
$G_1 \times T_7$	40.64	43.57	5.74	83.30
$G_1 \times T_8$	**37.64**	**48.71**	**7.98**	**79.63**
$G_1 \times T_9$	40.64	45.38	6.50	81.63
$G_1 \times T_{10}$	45.28	34.96	4.00	92.30
$G_2 \times T_1$	47.57	36.82	4.13	91.79
$G_2 \times T_2$	47.00	32.64	4.00	93.12
$G_2 \times T_3$	45.97	36.89	4.04	91.79
$G_2 \times T_4$	41.64	38.71	6.27	85.79
$G_2 \times T_5$	43.64	37.07	4.75	88.12
$G_2 \times T_6$	41.30	37.44	5.95	86.46
$G_2 \times T_7$	43.30	36.69	4.39	88.79
$G_2 \times T_8$	39.97	40.27	6.11	85.12
$G_2 \times T_9$	40.64	37.30	5.29	87.46
$G_2 \times T_{10}$	**48.14**	**30.68**	**3.83**	**95.46**
$G_3 \times T_1$	42.45	37.56	4.73	90.49
$G_3 \times T_2$	45.30	32.69	3.99	91.49
$G_3 \times T_3$	43.97	34.73	4.41	90.49
$G_3 \times T_4$	39.97	44.75	6.82	84.49
$G_3 \times T_5$	40.64	40.70	5.40	86.16
$G_3 \times T_6$	40.64	43.83	6.27	84.83
$G_3 \times T_7$	41.97	39.27	4.98	86.83
$G_3 \times T_8$	38.64	46.32	7.22	83.83
$G_3 \times T_9$	40.30	43.34	5.69	85.83
$G_3 \times T_{10}$	46.25	31.34	4.00	93.83
S.Em±	**1.93**	**1.40**	**0.29**	**3.63**
CD at 5%	**NS**	**3.97**	**0.81**	**NS**
CV %	**7.91**	**6.15**	**9.24**	**7.19**

Table 2: Effect of seed priming treatments to different genotypes and their interactions on number of pods per plant, number of seeds per pod, 100 seed weight (g) and seed yield per plant (g) in soybean

Treatments	Number of Pods/Plant	No. of Seeds/Pod	100 Seed Weight (g)	Seed Yield/ Plant (g)
Genotype (G)				
G_1 - GJS-3	**44.65**	**2.35**	**13.70**	**14.32**
G_2 - JS-20-29	**37.69**	**2.12**	**12.05**	**9.62**
G_3 - JS-335	42.45	2.27	13.16	12.61
S.Em±	0.51	0.03	0.16	0.29
CD at 5%	1.45	0.09	0.44	0.81
Priming treatment (T)				
T_1 - Control	38.89	2.09	12.74	10.16
T_2 - Cow urine (100%)	36.16	1.96	12.39	8.63
T_3 - Cow urine (50%)	38.14	2.00	12.55	9.40
T_4 - KH_2PO_4 (2%)	47.80	2.48	13.53	15.79
T_5 - KH_2PO_4 (1%)	41.97	2.33	13.15	12.68
T_6 - KNO_3 (2%)	45.21	2.43	13.37	14.55
T_7 - KNO_3 (1%)	40.68	2.20	12.90	11.33
T_8 - $CaCl_2$ (2%)	**49.67**	**2.71**	**13.73**	**18.44**
T_9 - $CaCl_2$ (1%)	43.40	2.37	13.26	13.38
T_{10} - Neem leaf extract (50%)	**34.05**	**1.89**	**12.07**	**7.46**
S.Em±	0.93	0.06	0.28	0.52
CD at 5%	2.65	0.16	0.80	1.48
Interaction (G × T)				
$G_1 \times T_1$	40.12	2.20	13.40	11.44
$G_1 \times T_2$	36.90	2.03	12.91	9.30
$G_1 \times T_3$	38.19	2.06	13.16	10.00
$G_1 \times T_4$	53.42	2.66	14.41	19.65
$G_1 \times T_5$	44.68	2.41	14.12	14.75
$G_1 \times T_6$	49.42	2.56	14.24	17.45
$G_1 \times T_7$	43.13	2.30	13.68	13.15
$G_1 \times T_8$	**57.11**	**2.86**	**14.62**	**23.54**
$G_1 \times T_9$	46.48	2.44	14.12	15.52
$G_1 \times T_{10}$	37.08	1.93	12.30	8.38
$G_2 \times T_1$	36.27	2.03	11.85	8.65
$G_2 \times T_2$	34.81	1.90	11.51	7.59
$G_2 \times T_3$	36.31	1.93	11.65	8.15
$G_2 \times T_4$	41.14	2.33	12.57	11.94
$G_2 \times T_5$	38.65	2.10	12.13	9.63
$G_2 \times T_6$	41.31	2.20	12.38	11.02
$G_2 \times T_7$	37.30	2.03	12.02	8.93
$G_2 \times T_8$	41.81	2.50	12.82	13.10
$G_2 \times T_9$	39.41	2.33	12.29	11.12
$G_2 \times T_{10}$	**29.88**	**1.83**	**11.30**	**6.04**
$G_3 \times T_1$	40.27	2.03	12.98	10.39
$G_3 \times T_2$	36.77	1.96	12.75	9.00
$G_3 \times T_3$	39.92	2.00	12.85	10.05
$G_3 \times T_4$	48.85	2.43	13.61	15.78
$G_3 \times T_5$	42.59	2.46	13.20	13.66
$G_3 \times T_6$	44.89	2.53	13.51	15.17
$G_3 \times T_7$	41.61	2.26	12.99	11.91
$G_3 \times T_8$	50.10	2.76	13.75	18.67
$G_3 \times T_9$	44.32	2.33	13.37	13.50
$G_3 \times T_{10}$	35.18	1.90	12.61	7.97
S.Em±	**1.62**	**0.10**	**0.49**	**0.90**
CD at 5%	**4.58**	**NS**	**NS**	**2.56**
CV %	**6.74**	**7.65**	**6.55**	**12.86**

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