Short Note

Effect of seed priming on growth, seed yield and quality of rice bean in Tehri region of Garhwal Himalaya

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Ricebean [*Vigna umbellata* [Thunb] Ohwi and Ohashi] is a neglected or underutilized crop grown under diverse conditions with no additional inputs. It thrives well in marginal lands, exhausted soil, rainfed and drought-prone areas. Ricebean is known by different local names *viz*., *Masyang*, *Jhilinge*, *Gurous* or *Siltung*, Naurangi or *Rayansh* in India and *Masyang* in Nepal. It is also known as climbing mountain bean, mambi bean, oriental bean, and haricot bean and is a native of South and South East Asia (Ohwi, 1965). Under Indian condition, its production is mainly confined to tribal region of North-Eastern region as *jhoom* cultivation and rainfed mixed farming and on a limited area of Western and Eastern Peninsular region and in sub temperate hilly tracts of Himanchal Pradesh and Uttarakhand (Arora, 1986). The wide adaptability of rice bean under different agro climatic conditions shows a tremendous potential of this underutilized crop for catering the nutritional and pulse requirement of burgeoning population of India. Not only this, it also has a tremendous potential for meeting the increasing demand of quality fodder for livestock's. Further ricebean is important for its nutritional strength in terms of dietary and functional fiber, slow digestible starch, quality protein, minerals, vitamins and bioactive phyto-chemicals and for many other health benefits. Ricebean has been sometimes substituted for adzuki bean in the making of pastry and can also be used as a green manure crop (Tharanathan and Mahadevamma, 2003; Tian *et al*., 2013 and Wei *et al.,* 2015). Being a leguminous crop it fixes nitrogen and thus can be taken as an intercrop. As most of the other crops, rice-bean also faces many biotic and abiotic stresses. Poor germination under moisture stress condition is one of the major cause which hampers the productivity of rice bean in India which could be minimized by adopting seed priming technique. Seed hydro priming is a simple and low cost hydration technique in which seeds are partially hydrated to a point where pre-germination, metabolic activities start without actual germination, and then re-dried until close to the original dry weight (Heydecker, 1973).Various seed priming methods *viz.* Hydro-priming (It involves soaking of seed in water, surface drying and sowing them on same day) , Halo-priming (refers to soaking of seeds in solution of inorganic salts like NaCl, KNO_3, etc.), Hormonal priming(It is the pre seed treatment with different hormones like GA3, kinetin, etc) and Hot water treatment have been documented in various field crops like maize, soybean, wheat, lentil, chickpea, mungbean, cowpea, etc (Furutani and Nagao, 1987; Singh, 1995; Cetinbas and Koyuncu, 2006 and Singh *et al*., 2015). Seed priming methods are used to improve seed germination rate, to reduce germination time, for getting synchronized germination and better seedling vigour in various field crops (Ashraf *et al*., 2001; Khan *et al*., 2009). However, a meagre work in relation to seed priming methods has been done on ricebean crop. Considering the above facts, an attempt has been taken to delineate the effect of various seed priming methods on ricebean crop.

A field experiment was carried out during *kharif* season 2017-18 at Research Block of College of Forestry, VCSG Uttarakhand University of Horticulture and Forestry, Ranichauri, Tehri Garhwal, Uttarakhand (at 30°15' N, 78°30' E and 2100 m amsl) to assess the effect of different seed priming techniques on growth, yield attributes and seed yield of two ricebean genotypes. The soil of the experimental site was clay loam in texture with pH 5.5 to 6.3, low available nitrogen; available phosphorous and available potash. The average maximum temperature, minimum temperature and rainfall during experimental period were 21.33^0C, 12.12^0C and 1181.10 mm respectively. Initially screening of four priming techniques *viz.* Hot water treatment at 55^0C for 10, 15, 20 minutes; Tap water treatment for 10, 12, 14 hours soaking; GA3 treatment at 250 ppm, 500 ppm and 750 ppm for 18 hours and KNO3 treatment at 0.2%, 0.4% and 0.6% for 18 hours were done under laboratory condition for selecting proper concentrations. Under laboratory condition higher germination per cent were obtained under hot water treatment at 55°C for 15 minutes (T_1), tap water soaking for 10 hours (T_2), 750 ppm GA3 treatment (T_3) and 0.4% KNO3 treatment (T_4) over the other treatment timings/ concentrations. On the basis of results obtained under laboratory condition, the experiment was further carried out in field condition using four priming techniques (T_1, T_2, T_3 and T_4) and unprimed Seeds i.e. absolute control (T_5) in two ricebean varieties (V_1: PRR-1 and V_2: PRR-2). The experiment consisting of ten treatment combinations (T_1V_1, T_1V_2, T_2V_1, T_2V_2, T_3V_1, T_3V_2, T_4V_1, T_4V_2, T_5V_1 and T_5V_2) was laid out in randomized block design with three replications. A uniform dose of 25 kg N, 45 kg P_2O_5 and 25kg K_2O/ha was applied as basal through Urea, DAP and MOP, respectively. Seeds were sown at about 5 cm depth manually after opening furrow at 25 cm apart and plant to plant spacing of 15 cm was maintained by thinning the extra plants at 25 days after sowing. The crop was raised as rainfed crop with normal crop husbandry. Standard procedures and techniques were followed to measure various growth parameters, yield attributes and seed yield. Data recorded were analyzed with the help of statistical programme- STPR- 2 developed by Department of Mathematics and Statistics, College of Basic Science and Humanities, Pantnagar, Uttarakhand, India.

The data pertaining to standard germination %, growth parameters, yield attributes and seed yield are given in Table 1. Priming methods significantly influenced standard germination (%). GA3 @ 750 ppm (T_3) remained significantly superior over all other priming methods. KNO3, @ 0.4 % (T_4) remained significantly superior over T_1, T_2 and T_5. The influence of two varieties was found to be non-significant for standard germination %. The different priming methods and varieties did not differ significantly in terms of field emergence and root length. However, maximum field emergence was observed for GA3 primed seeds which might be due to role of GA3 in reducing electrical conductivity and membrane injury index. Further, GA3 also help the breakdown of stored food material into sugars that promote germination through cell division (Sarika *et al.,* 2013). Days taken to 50% flowering and plant height at harvest were significantly influenced by different seed priming methods. Treatment T_3 (750 ppm GA3 treatment) took minimum days to attain 50 % flowering and remained statistically at par with T_1 (hot water treatment at 55 °C for 15 minutes) and T_4 (0.4% KNO_3 treatment). Early flowering may be due to higher endogenous level of GA3, early completion of vegetative growth and better nourishment of plants. Similar observations in advancement of flowering due to GA3 are reported by Khairul *et al*. (2015) in chickpea and Thomson *et al*. (2015) in garden pea. Treatment T_4 significantly resulted in higher plant height over the other priming methods except T_3 which remained at par with T_4. This might be due to the role of GA3 in mobilization of starch granules in cotyledons and thus stimulating germination and growth and also for its role increasing inter-node length and encouraging cell division (Kaur *et al.*, 1998). Similar findings were also reported by Naeem and Muhammad (2006) and Ghodrat and Rousta (2012). The varieties did not differ significantly for days taken to 50 % flowering and plant height at maturity. Yield attributes were significantly influenced by various priming methods, however, the effect of two varieties did not influenced the yield attributes significantly. Seed priming with 750 ppm GA3 (T_3) resulted in more number of primary branches/plant as well as total number of pods/plant and remained significantly superior over all other treatments except T_4 which did not differ significantly for both the yield attribute. This might be due to earlier field emergence and increased photosynthetic activity with the application of GA3. This is in line with the findings of Khairul *et al.* (2015) and Mazed *et al*. (2015) in chickpea.

Table 1: Crop performance in relation to seed priming methods and rice bean varieties

Treatments	Growth parameters					Yield attributes			Seed
Priming method	Standard Germination * (%)	Field emergence (%)	Root length (cm) at harvest	Days to 50% flowering	Plant height (cm) at harvest	Primary branches/ plant	Pod/ plant	100- seed weight (g)	yield (q/ha)
T_1	83.12	72.50	24.87	79.07	24.85	4.63	14.80	6.02	21.14
T_2	82.75	75.50	22.64	82.15	26.61	4.51	14.24	6.57	22.49
T_3	91.50	84.67	23.40	76.53	32.36	6.10	16.87	7.58	29.03
T_4	88.00	79.17	23.69	77.57	32.99	5.06	15.47	7.10	25.30
T_5	80.12	67.50	20.15	83.66	24.58	3.95	12.02	5.88	17.90
SEm±	0.5	3.14	1.87	1.14	1.51	0.35	0.58	0.15	0.64
CD(P=0.05)	1.94	NS	NS	3.38	4.49	1.05	1.73	0.44	1.90
Varieties									
V_1	84.80	76.20	23.27	80.18	29.50	4.87	14.83	6.87	23.40
V_2	85.10	75.53	22.62	79.40	27.05	4.82	14.52	6.39	22.94
SEm±	0.31	0.67	1.18	0.72	0.95	0.22	0.37	0.95	0.40
CD(P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

T_1: hot water treatment at 55 °C for 15 minutes, T_2: tap water soaking for 10 hours, T_3:750 ppm GA3 treatment, T_4:0.4% KNO_3 treatment, T_5: unprimed Seeds i.e. absolute control V_1: PRR-1 and V_2: PRR-2*Standard germination % was calculated under laboratory condition

Significantly lower number of primary branches/plant and pods/plant were observed with the treatment T_5 **(**unprimed Seeds i.e. absolute control**)**. Treatment T_3 remained significantly superior over all the other seed priming methods for 100- seed weight. This is in line with the findings of Jafri *et al.* (2015) and Naghashzadeh *et al.* (2009). The order of 100- seed weight follows the following sequence $T_3>T_4>T_2>T_1>T_5$. T_4 remained significantly superior over T_2, T_1 and T_5 in weight of 100 seeds. Different priming methods had a significant effect on seed yield. Seed treatment with 750 ppm GA3 (T_3) gave maximum seed yield and remained significantly superior over all the other treatments. For seed yield also similar trend was observed as in case of 100 seed weight. Higher growth parameters and yield attributes might have resulted in higher yield in case of seed priming with GA3 at 750 ppm concentration. Similar findings have been reported by Khairul *et al.* (2015) and Iqbal and Ashraf, (2013) in chickpea and wheat, respectively. Among the two varieties, maximum seed yield was observed in PRR-1(V_1), however difference were found to be non-significant.

CONCLUSION

From the study it could be concluded that seed priming of ricebean with GA3 (750ppm) might be helpful in improving seed yield of farmers of Tehri Garhwal region of Uttarakhand. As the experiment was carried out for one crop season only, it needs to be repeated for at least one more season for reconfirmation of the results.

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