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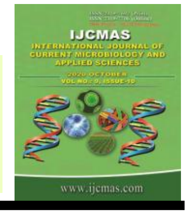

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Effect of Bulb Priming and Foliar Sray on Germination and Seed Yield in Onion (*Allium cepa* L)

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ABSTRACT

An experiment was laid out in a factorial RBD with three replications involving two lots (unsprayed and sprayed at 45 and 60 days) and eight bulb priming treatments. Bulbs after $1/3^{rd}$ cutting were primed with zinc (0.5 and 0.75%), magnesium (0.5 and 0.75%), calcium (0.5 and 0.75%) and GA_3 (50 and 100ppm) for 6 hours and kept in 1% carbendazim solution for 15 minutes. Bulbs were planted in plot at a spacing of 60 x 30 cm as per treatments along with control. The observations on germination, days to 50% flowering, height of stalk, number of umbels, circumference of umbel, days to maturity, per plant yield (g), seed yield per hectare (kg), germination percentage and seedling vigour of harvested seed were recorded. In the study it was revealed that sprayed lot (foliar spraying at 45 and 60 days) performed well over unsprayed lot for seed yield. Among the treatments, calcium (0.75%) at par with calcium (0.5%) was significantly superior over other treatments for seed yield. Treatment with GA_3 (100 ppm) recorded minimum days to maturity while calcium (0.75%) treatment required maximum days for maturity. The seed quality parameters *viz.* germination percentage and seedling vigour recorded superiority of sprayed lot (foliar spraying at 45 and 60 days) over unsprayed lot.

Introduction

Onion (*Allium cepa* L.) originated from Central Asia is one of the most important commercial crops grown throughout the world. It contributes about 7 per cent share in total vegetable production (Anonymous, 2011). It is known fact that seed is a basic and crucial input in agriculture. The quality of seed decides the commercial success of a crop / variety. Farmers need high quality seed, since high quality seed is the basis of higher agricultural productivity. Furthermore, there is an interest among vegetable growers to predict emergence, due to an increasing need to schedule their crop in precision to meet market demands for continuity of high quality products. To ensure the success of any planting program a regular and continuous supply of high quality seed is vital.

Poor quality seed sources can result in plantation failures or considerable losses in production (Shehata *et al.*, 2012). The work on bulb priming with insecticides and fungicides is conducted by various scientists. However work on bulb priming with osmoticants is not reported. Seed priming appears to reverse the detrimental effects of seed deterioration. During priming repair of DNA, RNA, protein, membranes and enzymes occurs. Oxygen is also increased, suggesting that respiratory activity is an essential component of repair. Priming increases enzyme activity such as α - amylase activity which break down starch stored in seeds to be utilized by growing embryos during germination.

Uniformity and percentage of seedling emergence have a direct impact on final yield and quality and are decided by the quality of seed used for sowing and the environmental conditions prevailing during seedling emergence. Pre-plant or pre-sowing seed treatments are used to maximize stand establishment and yield by mobilizing seeds own resources and to augment them with external resources (Salter, 1985).

Priming stimulates many of the metabolic processes involved with the early phases of germination. As part of the germination process have been initiated due to priming, seedlings from primed seed grow faster, grow more vigourously, and perform better in adverse conditions (Basker and Hatton, 1987; Desai *et al.,* 1997). The objective of the present work is to determine the effect of bulb priming treatments and foliar spray treatments on onion seed production and seed quality.

Materials and Methods

The experiment was conducted at Seed Farm, MPKV, Rahuri in a factorial randomized block design with three replications. The bulbs harvested from one year old seed lot with priming treatments of zinc (0.5 and 0.75%), magnesium (0.5 and 0.75%), calcium (0.5 and 0.75%) and GA_3 (50 and 100ppm) for 6 hours along with control were used. Bulbs after $1/3^{rd}$ cutting were primed with zinc (0.5 and 0.75%), magnesium (0.5 and 0.75%), calcium (0.5 and 0.75%) and GA_3 (50 and 100ppm) for 6 hours and were kept in 1% carbendazim solution for 15 minutes. Same priming treatment was given to respective harvested bulbs of previous season experiment of bulb production. Bulbs were planted in plot of 3 x 3 m^2 at a spacing of 60 x 30 cm as per treatments. All the inter-culturing operation were followed during the experimentation. Earthing up was done. The spraying of insecticides and pesticides was done to protect crop from the attack of pests and diseases.

Sprayed and unsprayed lot

One set of bulb treatments was sprayed with micro-nutrients and GA_3 on 45^{th} and 60^{th} day while another set was kept untreated control.

Spraying treatments on 45^{th} & 60^{th} day for seed production

Bulb treatments		Spraying treatments	
T_1-Zinc	0.5 %	Zinc	0.25 %
T_2-Zinc	0.75 %	Zinc	0.5 %
T_3-Magnesium	0.5 %	Magnesium	0.25 %
T_4-Magnesium	0.75 %	Magnesium	0.5 %
T_5-Calcium	0.5 %	Calcium	0.25 %
T_6-Calcium	0.75 %	Calcium	0.5 %
T_7-GA_3	50 ppm	GA_3	20 ppm
T_8-GA_3	100 ppm	GA_3	50 ppm
T_9-Control (bulbs from old seed lot)		No spray	

Laboratory and field observations were recorded and statistical analysis was done by following the standard ANOVA method for Factorial Randomized Block analysis (Panse and Sukhatme, 1985).

Results and Discussion

The work on bulb priming with insecticides and fungicides is conducted by various scientists. However, bulb priming with osmoticants is not reported.

The difference among the bulb lot was non significant for germination of bulbs. Treatments of bulbs had significant variation i.e. germination of bulbs was influenced by the bulb treatments. The interaction was non significant. Germination percentage was improved due to bulb treatments.

Non significant difference for speed of emergence recorded for both the sprayed and unsprayed lots. Whereas, the treatment effect had noticed. The treatment with T_8 (GA_3 100ppm, 6.56) was significantly superior. The interaction effect was non significant. After bulb treatment, it was found that sprouting of bulbs was earlier in primed bulbs than control indicating that bulb priming accelerates germination.

Non significant difference was recorded for days to 50 % flowering in sprayed and unsprayed lots. In the treatments, T_7 (GA_3 50 ppm, 117 d) required minimum days for 50% flowering. Treatment T_6 calcium (0.75%) required maximum days for 50% flowering i.e.124.17 d. The interaction was non significant.

The height of stalk had non significant effects in both sprayed and unsprayed lots. In the case of treatments it showed significant differences. The treatment T_6 (calcium 0.75 %) had superior height with T_1 (zinc 0.5 %) at par with each other. The interaction for height of stalk was non significant. The enhancing effect of the micronutrients may be attributed to its role in enhancing plant growth and its role in many processes. Abd El- Samad *et al.*, (2011) showed that foliar spraying of micronutrients had positively significant effect on plant growth, yield, quality and mineral contents of onion plants. They concluded that foliar spraying of Zn gave the superiority of all measured parameters than other treatments.

Unsprayed lot had significantly more number of umbels than the sprayed lot. The treatments of bulbs showed non significant difference. The interaction was also non significant.

Non significant difference for circumference of the umbel was recorded in both the sprayed and unsprayed lots. Among the treatments T_6 (calcium 0.75 %) had significantly superior circumference and was at par with T_1 (zinc 0.5%) and T_5 (calcium 0.5 %). The interaction was non significant.

In case of per plant yield, no significant differences were found among the sprayed and unsprayed lots. In treatments it showed significant variation. Among the treatmentsT_6 (calcium 0.75 %, 23.06g) was significantly superior and was at par with T_5 (calcium 0.5 %, 21.28 g) at par.

Treatment with calcium was superior which might be due to major role of calcium in the formation of the cell wall membrane and thus gives strength to the plant. It acts as an activator of several enzymes. It combines with anions including organic acids, sulphate and phosphates. It acts as a detoxifying agent by neutralizing organic acids. Calcium indirectly assists in improving crop yield by regularizing soil reaction (Table 1 and 2).

Table.1 Effect of bulb priming and foliar spray treatments on germination, plant growth characters

Treatments	Speed of emergence	Final Germination (%)	Days to 50% flowering	Height of stalk (cm)	Number of umbels	Circumference of umbels (cm)
Sprayed lot L_1						
T_1 (Zinc 0.5 %)	6.26	97.33	116.67	72.80	5.47	**19.04**
T_2 (Zinc 0.75 %)	6.51	98.67	117.33	70.20	4.73	**18.28**
T_3(Magnesium0.5 %)	6.34	98.67	118.00	70.53	4.33	**19.30**
T_4(Magnesium0.75 %)	5.98	96.67	119.00	71.01	5.53	**18.46**
T_5 (Calcium 0.5 %)	6.33	95.33	118.67	66.73	5.13	**18.69**
T_6 (Calcium 0.75 %)	5.18	95.33	125.00	76.60	5.93	**20.53**
T_7 (GA_3 50 ppm)	6.24	96.67	117.33	62.73	5.00	**17.88**
T_8 (GA_3 100 ppm)	6.46	97.33	117.67	60.40	5.20	**17.22**
T_9 (Control)	5.78	93.33	118.33	68.73	5.20	**18.30**
Mean	6.12	96.59	118.67	68.86	5.17	**18.63**
Unsprayed lot L_2						
T_{10} (Zinc 0.5 %)	6.30	96.67	117.67	70.20	5.47	**19.14**
T_{11} (Zinc 0.75 %)	6.53	98.00	117.33	66.87	6.20	**17.87**
T_{12} (Magnesium0.5 %)	6.36	98.67	119.00	68.20	5.53	**17.91**
T_{13} (Magnesium0.75 %)	6.02	96.67	120.33	68.47	6.13	**18.09**
T_{14} (Calcium 0.5 %)	6.39	95.33	118.00	72.40	5.80	**18.97**
T_{15} (Calcium 0.75 %)	5.18	95.33	123.33	72.60	6.60	**19.85**
T_{16} (GA_3 50 ppm)	6.30	96.00	116.67	60.53	5.53	**17.55**
T_{17} (GA_3 100 ppm)	6.67	97.33	118.00	60.93	5.13	**17.05**
T_{18} (Control)	5.75	92.66	118.33	68.73	5.20	**18.30**
Mean	6.17	96.30	118.74	67.93	5.73	**18.30**
Lot S.E.	0.064	0.200	0.420	0.731	0.175	**0.238**
C.D. at 5%	NS	NS	NS	NS	0.502	**NS**
Treatment S.E.	0.135	0.425	0.892	1.551	0.371	**0.506**
C.D. at 5%	0.389	1.222	2.563	4.457	NS	**1.454**
Interaction S.E.	0.191	0.601	1.261	2.193	0.524	**0.715**
C.D. at 5%	**NS**	**NS**	**NS**	**NS**	**NS**	NS

Table.2 Effect of bulb priming and foliar spray treatments on seed yield and quality

Treatments	Yield/ha (kg)	Per plant yield (g)	Days to maturity	Germination (%)	Seedling Vigour Index
Sprayed lot L_1					
T_1 (Zinc 0.5 %)	728.88	19.41	145.33	95.55	**1738.74**
T_2 (Zinc 0.75 %)	754.96	18.85	147.00	97.00	**1755.6**
T_3 (Magnesium0.5 %)	688.59	18.79	145.67	95.66	**1726.49**
T_4 (Magnesium0.75 %)	669.03	19.38	145.00	95.66	**1710.01**
T_5 (Calcium 0.5 %)	761.47	20.51	147.33	96.66	**1697.97**
T_6 (Calcium 0.75 %)	853.62	23.06	155.67	96.11	**1775.11**
T_7 (GA_3 50 ppm)	678.21	18.28	141.33	95.33	**1639.90**
T_8 (GA_3 100 ppm)	705.18	18.72	140.00	95.55	**1677.35**
T_9 (Control)	547.85	15.01	149.00	95.66	**1556.44**
Mean	709.76	19.11	146.26	95.91	**1697.51**
Unsprayed lot L_2					
T_{10} (Zinc 0.5 %)	687.10	19.32	145.33	93.77	**1649.19**
T_{11} (Zinc 0.75 %)	628.14	15.98	147.33	94.44	**1638.39**
T_{12} (Magnesium0.5 %)	695.11	17.24	146.00	93.22	**1584.65**
T_{13} (Magnesium0.75 %)	602.36	17.61	144.67	93.89	**1582.86**
T_{14} (Calcium 0.5 %)	779.85	22.05	148.67	94.89	**1635.33**
T_{15} (Calcium 0.75 %)	777.47	23.06	155.00	94.00	**1662.73**
T_{16} (GA_3 50 ppm)	611.55	16.97	139.67	94.33	**1649.43**
T_{17} (GA_3 100 ppm)	600.59	16.73	139.67	93.44	**1583.38**
T_{18} (Control)	547.85	15.01	149.00	95.66	**1556.44**
Mean	658.89	18.22	146.15	94.18	**1615.87**
Lot S.E.	11.218	0.424	0.201	0.169	**9.728**
C.D. at 5%	32.241	NS	NS	0.485	**27.959**
Treatment S.E.	23.797	0.900	0.428	0.358	**20.636**
C.D. at 5%	68.393	2.587	1.229	1.029	**59.309**
Interaction S.E.	33.654	1.273	0.605	0.506	**29.184**
C.D. at 5%	**NS**	**NS**	**NS**	**NS**	**NS**

Sprayed lot (709.76 kg) was significantly superior over non sprayed lot (658.89 kg) for per hectare yield. Within the treatments significant differences were observed. Treatment T_6 (calcium 0.75 %, 815.55 kg) performed superior over other treatments with T_5 (calcium 0.5 %, 770.66 kg) at par. Interaction had non significant differences. Malakouti (2008) observed that micronutrients can increase grain yield upto 50% as well as macronutrient use efficiency. According to Marschner (1995) the enhancing effect of these commercial compounds may be attributed to its role in enhancing plant growth and its role in many biochemical and physiological process such as chlorophyll and protein synthesis, mineral uptake, the role in photosynthesis and activation of enzymatic system. All these processes will enhance growth as well as productivity. Geetharani *et al.,* (2008) conducted field experiment to study the effect of growth regulators and nutrients on onion seed production. Spraying of NAA (100 ppm) at first flower stalk emergence and second spray at 10% flowering stage (i.e. 35 and 45 DAP) enhanced seed recovery and yield by 22.7%.

In days to maturity no significant variation among the sprayed and unsprayed lot was observed. The bulb treatment T_8 ($GA_3$100 ppm) required minimum days for maturity (139.83 DAS) which is at par with T_7 (GA_3 50 ppm). Treatment T_6 (calcium 0.75%) required maximum days for maturity i.e. 155.33 DAS.

Significant differences for germination percentage among the sprayed and unsprayed lots were observed at laboratory condition. Sprayed lot (95.91%) was significantly superior over unsprayed lot (94.18%). In treatments significant variation for germination was found. The treatment T_5 (calcium 0.5 %) with germination 95.78% was significantly superior. The interaction was non significant. Spraying at 45 and 60 days was found to be beneficial as the germination percentage was improved.

In the case of seedling vigour index sprayed lot (1697.51) was significantly superior over unsprayed lot (1615.87). Among the treatments significant differences were observed. Treatment T_6 (calcium 0.75%, 1718.92) was significantly superior over the treatments and at par with treatment T_2, T_1, T_5. The interaction was non significant. Seed quality was found to be improved due to foliar spraying at 45 and 60 days because seedlings from these treatments were vigourous than unsprayed treatments.

It can be concluded that in seed production sprouting of bulbs was earlier due to bulb priming treatments. Speed of emergence was accelerated by GA_3 100 ppm priming treatment. Flowering and maturity was delayed in seed production due to calcium 0.75% treatment whereas early maturity was attained due to GA_3 100 ppm treatment. Bulb treatment with calcium 0.75% proved better for seed yield. Germination and seedling vigour was improved due to spraying treatments as compared to unsprayed treatments.

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