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Effect of Bulb Priming and Foliar Spray 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 1/3rd cutting were primed with zinc (0.5 and 0.75%), magnesium (0.5 and 0.75%), calcium (0.5 and 0.75%) and GA₃ (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 GA₃ (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.

Keywords
Onion, Allium cepa, priming, Foliar spray, Germination, Seed yield

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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 GA₃ (50 and 100ppm) for 6 hours along with control were used. Bulbs after 1/3rd cutting were primed with zinc (0.5 and 0.75%), magnesium (0.5 and 0.75%), calcium (0.5 and 0.75%) and GA₃ (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 m² 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 GA₃ on 45th and 60th day while another set was kept untreated control.

### Spraying treatments on 45th & 60th day for seed production

| Bulb treatments | Spraying treatments |
|-----------------|---------------------|
| T₁-Zinc 0.5 %   | Zinc 0.25 %         |
| T₂-Zinc 0.75 %  | Zinc 0.5 %          |
| T₃-Magnesium 0.5 % | Magnesium 0.25 %  |
| T₄-Magnesium 0.75 % | Magnesium 0.5 %  |
| T₅-Calcium 0.5 % | Calcium 0.25 %     |
| T₆-Calcium 0.75 % | Calcium 0.5 %     |
| T₇-GA₃ 50 ppm   | GA₃ 20 ppm          |
| T₈-GA₃ 100 ppm  | GA₃ 50 ppm          |
| T₉-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 T₈ (GA₃ 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, T₇ (GA₃ 50 ppm, 117 d) required minimum days for 50% flowering. Treatment T₆ 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 T₆ (calcium 0.75 %) had superior height with T₁ (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 T₆ (calcium 0.75 %) had significantly superior circumference and was at par with T₁ (zinc 0.5%) and T₅ (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 treatments T₆ (calcium 0.75 %, 23.06g) was significantly superior and was at par with T₅ (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 L₁ |                   |                       |                       |                     |                 |                             |
| T₁ (Zinc 0.5 %) | 6.26 | 97.33 | 116.67 | 72.80 | 5.47 | 19.04 |
| T₂ (Zinc 0.75 %) | 6.51 | 98.67 | 117.33 | 70.20 | 4.73 | 18.28 |
| T₃ (Magnesium 0.5 %) | 6.34 | 98.67 | 117.33 | 70.53 | 4.33 | 19.30 |
| T₄ (Magnesium 0.75 %) | 5.98 | 96.67 | 111.67 | 71.01 | 5.53 | 18.46 |
| T₅ (Calcium 0.5 %) | 6.33 | 95.33 | 118.67 | 66.73 | 5.13 | 18.69 |
| T₆ (Calcium 0.75 %) | 5.18 | 95.33 | 125.00 | 76.60 | 5.93 | 20.53 |
| T₇ (GA₃ 50 ppm) | 6.24 | 96.67 | 117.33 | 62.73 | 5.00 | 17.88 |
| T₈ (GA₃ 100 ppm) | 6.46 | 97.33 | 117.67 | 60.40 | 5.20 | 17.22 |
| T₉ (Control) | 5.78 | 93.33 | 118.00 | 68.73 | 5.20 | 18.30 |
| Mean | 6.12 | 96.59 | 118.67 | 68.86 | 5.17 | 18.63 |
| Unsprayed lot L₂ |                   |                       |                       |                     |                 |                             |
| T₁₀ (Zinc 0.5 %) | 6.30 | 96.67 | 117.67 | 70.20 | 5.47 | 19.14 |
| T₁₁ (Zinc 0.75 %) | 6.53 | 98.00 | 117.33 | 66.87 | 6.20 | 17.87 |
| T₁₂ (Magnesium 0.5 %) | 6.36 | 98.67 | 119.00 | 68.20 | 5.53 | 17.91 |
| T₁₃ (Magnesium 0.75 %) | 6.02 | 96.67 | 120.33 | 68.47 | 6.13 | 18.09 |
| T₁₄ (Calcium 0.5 %) | 6.39 | 95.33 | 118.00 | 72.40 | 5.80 | 18.97 |
| T₁₅ (Calcium 0.75 %) | 5.18 | 95.33 | 123.33 | 72.60 | 6.60 | 19.85 |
| T₁₆ (GA₃ 50 ppm) | 6.30 | 96.00 | 116.67 | 60.53 | 5.53 | 17.55 |
| T₁₇ (GA₃ 100 ppm) | 6.67 | 97.33 | 118.00 | 60.93 | 5.13 | 17.05 |
| T₁₈ (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 L₁**  |               |                     |                  |                |                      |
| T₁ (Zinc 0.5 %)     | 728.88        | 19.41               | 145.33           | 95.55          | 1738.74              |
| T₂ (Zinc 0.75 %)    | 754.96        | 18.85               | 147.00           | 97.00          | 1755.6               |
| T₃ (Magnesium 0.5 %) | 688.59        | 18.79               | 145.67           | 95.66          | 1726.49              |
| T₄ (Magnesium 0.75 %) | 669.03        | 19.38               | 145.00           | 95.66          | 1710.01              |
| T₅ (Calcium 0.5 %)  | 761.47        | 20.51               | 147.33           | 96.66          | 1697.97              |
| T₆ (Calcium 0.75 %) | 853.62        | 23.06               | 155.67           | 96.11          | 1775.11              |
| T₇ (GA₃ 50 ppm)     | 678.21        | 18.28               | 141.33           | 95.33          | 1639.90              |
| T₈ (GA₃ 100 ppm)    | 705.18        | 18.72               | 140.00           | 95.55          | 1677.35              |
| T₉ (Control)        | 547.85        | 15.01               | 149.00           | 95.66          | 1556.44              |
| **Mean**            | 709.76        | 19.11               | 146.26           | 95.91          | 1697.51              |
| **Unsprayed lot L₂**|               |                     |                  |                |                      |
| T₁₀ (Zinc 0.5 %)    | 687.10        | 19.32               | 145.33           | 93.77          | 1649.19              |
| T₁₁ (Zinc 0.75 %)   | 628.14        | 15.98               | 147.33           | 94.44          | 1638.39              |
| T₁₂ (Magnesium 0.5 %) | 695.11        | 17.24               | 146.00           | 93.22          | 1584.65              |
| T₁₃ (Magnesium 0.75 %) | 602.36        | 17.61               | 144.67           | 93.89          | 1582.86              |
| T₁₄ (Calcium 0.5 %) | 779.85        | 22.05               | 148.67           | 94.89          | 1635.33              |
| T₁₅ (Calcium 0.75 %) | 777.47        | 23.06               | 155.00           | 94.00          | 1662.73              |
| T₁₆ (GA₃ 50 ppm)    | 611.55        | 16.97               | 139.67           | 94.33          | 1649.43              |
| T₁₇ (GA₃ 100 ppm)   | 600.59        | 16.73               | 139.67           | 93.44          | 1583.38              |
| T₁₈ (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 $T_3$ (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.

**References**

Abd El-Shamad, E.H., R.K.M. Khalifa, Z.A. Lashine and M.R. Shafeek (2011). Influence of urea fertilization. Australian Journal of Basic and Applied Scinces: Vol.: 5(5), pp.96-103.

Anonymous (2011). National Horticulture Board 2011, Major vegetable producing countries in the world. pp. 238.

Baskar, A. M. and W. Hatton (1987). Calcium peroxidase as a seed coating material for paddy rice. III. Glasshouse trials. Plant Soil, Vol.: 99, pp. 379-387.

Desai, B. B., P. M. Kotecha and D. K.
Salunkhe (1997). *Seeds Handbook*, Marcel Dekker, Inc. New York.
Geetharani, P., M. I. Manivannan and A. S. Ponnuswamy (2008). Seed production of onion as influenced by the application of growth regulators and nutrients. Asian Journal of Horticulture. Vol. 3(2), pp. 301-303.
Malakouti, M.J. (2008). The effect of micronutrients in ensuring efficient use of macronutrients. Turk J. Agric., Vol.: 32, pp. 215-220.
Marschner, H. (1995). Mineral nutrition of higher plants. Academic Press, London, pp. 313-404.
Panse, V. G. and P. V. Sukhatme (1985). Statistical method for agricultural workers. ICAR, New Delhi.
Salter, P.J. (1985). Crop Establishment. Recent research and trends in commercial practice. Scientific Horti., Vol.: 36, pp. 32-47.
Shehata, S.A., M.Y.Hashem, G.I.Mehmoud and K. F. Abd El-Gawad (2012). Effect of some pre-harvest treatments on onion seed production under sandy soil conditions. Journal of Applied Sciences Research, Vol.: 8 (2), pp.763-769.

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