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*RESEARCH PAPER*

# Foliar application of boron, urea and $GA_3$ influences earliness of curd production in broccoli (*Brassica oleracea* var. italica)

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**Abstract :** Broccoli (*Brassica oleracea* var. *italica*) which belongs to *Brassicaceae* family, is an Italian vegetable, native to Mediterranean region. Although broccoli is not so popular yet in Jharkhand, it is slowly gaining popularity during the last few years among the consumers due to its nutritional value including flavour, taste, carotenoids and anticancerous properties. Among the entire cole family, broccoli is rated as most remunerative. To assess the impact of foliar spray of boron, Urea and $GA_3$ on earliness in curd production of broccoli cv. FIESTA under Ranchi condition, experiments were carried out at the Department of Horticulture, Birsa Agricultural University, Ranchi, Jharkhand during winter season of 2013-14 and 2014-15, The experiment was done in Randomized Block Design having sixteen different treatments with three replications. It was recorded that various treatments have influenced the days to curd initiation, days to 50% of curd initiation, days to curd maturity. In general it was recorded that urea application @ 1.0% and 1.5% had advanced the days of initiation and maturity of the curd. Spray of $GA_3$ at different concentrations of 25 ppm, 50 ppm and 75 ppm had influenced the earliness of the curd positively. $GA_3$ @ (75 ppm) in combination of urea @ (0.5%) and Boron @ (2%) however enhanced the earliness maximum.

**Key Words :** Broccoli, Foliar spray, Earliness of curd production

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## INTRODUCTION

Broccoli (*Brassica oleracea* var italica) is an important cole crop belonging to Crucifer family. Being native to Mediterranean region, its cultivation started in Italy in ancient roman times. The green inflorescence is the commercial product of this crop, which is highly nutritious . It is rich in chlorophyll, ascorbic acid and good source of vitamins and minerals (Fabek *et al.*, 2012) and some bioactive compounds such as phenolics, flavonoids and glucosinolates that possess antioxidant and

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anticancer effects (Beecher, 1994). It is gaining fast popularity during the last few years among the consumer particularly in and around bigger cities owing to the increased awareness about the nutritional properties as well as palatability.

Broccoli requires good fertilization to achieve good yield. Nitrogen acts as an integral part of enzyme system, vitally connected with chlorophyll formation. Insufficient nitrogen applications may cause either yield reduction or some physiological disorders like hollow stem, and some pathological problems like head rot in the broccoli crop (Belec *et al.,* 2001). Boron is an important micro nutrient for this crop and regulates several physiological and biochemical processes. Its application reduces quality defects and increases head yield. Foliar application of Boron is effective in reducing the post harvest spoilage of the crop due to infection in cavities of hollow stem. The basic role of boron lies in stabilizing certain constituent of cell wall and plasma membrane and enhancing membrane permeability, cell elongation, cell division, tissue differentiation and metabolism of nucleic acid, carbohydrate, protein, auxin and phenols.

Gibberellins are known to show most striking response on various growth and developmental phases of growing plants. It has marked influence on flowering and fruiting characters (Booij, 1990 and Aditya and Fordham, 1995). $GA_3$ and kinetin exhibited beneficial effect in several cole crops (Chhonkar and Singh, 1963 and Badawi and Sahhar, 1978). Little investigations have been conducted to evaluate the response of combinations of Urea, Boron and $GA_3$ on earliness of curd production of sprouting broccoli. Thus the present investigation is carried out to study their impact on the earliness of this crop.

## MATERIAL AND METHODS

The experiment was conducted during the winter season of 2013-14 and, 2014-15 at the Horticulture farm of Birsa Agricultural University, Ranchi, Jharkhand. The experimental site comes under the seventh Agroclimatic region of the country *i.e.* Eastern plateau and hills which enjoys a sub-tropical climate with summer comparatively cool, heavy rainy season and moderate winter. The experiment was laid done in Randomized Block Design (RBD) with three replications and 16 treatments. The treatments composed of various concentration of Urea, $GA_3$ and boron in different combinations and a control was used with no spray. After transplanting a regular inspection of farm was done to observe curd initiation. Time taken for first curd initiation and 50% of curd initiation was noted. Days to curd maturity per replication in different treatments were recorded and average number of days to curd maturity was calculated.

## RESULTS AND DISCUSSION

The early maturity of a vegetable crop gives extra income to a farmer as the rates are high as well as field will be ready for sowing for other crops. This dual benefit encourages us to bring earliness in the crop production. It was recorded from the investigation that in general, Urea has enhanced the curd initiation as well as curd maturity period, though this enhancement may not be significant when compared to control, however individual doses of boron didn't significantly affected the maturity period. Secondary the increasing doses of $GA_3$ have reduced the curd initiation as well as maturity period. Further the combination of Urea @ 0.5%, $GA_3$ @ 75ppm and B as borax @ 2% had acquired the minimum value of curd initiation and maturity. The result is in closed conformity of Chhonkar and Singh (1964); Chauhan and Singh (1970); Singh (1991); Reddy (1989) and Mareczek *et al.* (2005). This early curd formation and maturity due to $GA_3$ application might be attributed to the increased rate of physiological activity, photosynthesis and auxin level in plants which resulted into accelerated movement of photosynthates and the building up of sufficient food stocks for initiation of primordia and bud formation. However the delay in curd maturity due to application of foliar Urea may be attributed to the increased rate of vegetative growth which might have suppressed the reproductive growth for some time. In case of B we noticed that, when it is applied individually it has no effect, but the combination of Urea @ (0.5%) and $GA_3$ (75ppm), significantly reduced the maturity period. A combination of Urea @ (0.5%), $GA_3$ @ (25ppm) and B as borax @ 1% as well as the combination of Urea (0.5%) + $GA_3$ (50ppm) + B as borax (1.5%) also significantly reduced the initiation and maturity period. This might be due to the synergistic effect of all three which may result in reduction in the period of curd maturity.

**Table 1 : Effect of various treatments on days to curd initiation, days to 50 per cent curd initiation and days to curd maturity of broccoli in the year 2013-14**

| Treatments | | Days to curd initiation | Days to 50% curd initiation | Days to curd maturity |
|---|---|---|---|---|
| $T_1$ | Urea (0.5%) | 64.46 | 71.00 | 102.00 |
| $T_2$ | Urea (1.0%) | 64.64 | 72.61 | 103.19 |
| $T_3$ | Urea (1.5%) | 64.14 | 73.15 | 103.74 |
| $T_4$ | $GA_3$ (25 ppm) | 61.52 | 66.36 | 98.44 |
| $T_5$ | $GA_3$ (50 ppm) | 58.51 | 67.73 | 97.89 |
| $T_6$ | $GA_3$ (75 ppm) | 56.33 | 64.00 | 95.76 |
| $T_7$ | B as borax (1.0%) | 61.50 | 68.70 | 102.33 |
| $T_8$ | B as borax (1.5%) | 60.08 | 67.84 | 102.26 |
| $T_9$ | B as borax (2.0%) | 60.61 | 67.41 | 102.15 |
| $T_{10}$ | Urea (0.5%) + $GA_3$ (25 ppm) | 59.10 | 66.73 | 98.35 |
| $T_{11}$ | Urea (1.0%) + $GA_3$ (50 ppm) | 63.00 | 67.52 | 100.19 |
| $T_{12}$ | Urea (1.5%) + $GA_3$ (75 ppm) | 64.61 | 69.96 | 102.51 |
| $T_{13}$ | Urea (0.5%) + $GA_3$ (25 ppm) + B as borax (1%) | 59.37 | 66.62 | 98.23 |
| $T_{14}$ | Urea (0.5%) + $GA_3$ (50 ppm) + B as borax (1.5%) | 58.15 | 65.93 | 98.32 |
| $T_{15}$ | Urea (0.5%) + $GA_3$ (75 ppm) + B as borax (2%) | 55.66 | 64.66 | 95.43 |
| $T_{16}$ | Control | 63.95 | 71.83 | 102.15 |
| | S.E. ± | 0.74 | 0.69 | 0.80 |
| | C.V. % | 2.10 | 1.76 | 1.38 |
| | C.D. (P=0.05) | 2.14 | 2.00 | 2.31 |

**Table 2 : Effect of various treatments on days to curd initiation, days to 50 per cent curd initiation and days to curd maturity of broccoli in the year 2014-15**

| | Treatments | Curd initiation | Curd initiation 50% | Days to curd maturity |
|---|---|---|---|---|
| $T_1$ | Urea (0.5%) | 62.47 | 75.48 | 103.00 |
| $T_2$ | Urea (1.0%) | 65.87 | 74.48 | 107.33 |
| $T_3$ | Urea (1.5%) | 67.15 | 75.01 | 107.84 |
| $T_4$ | $GA_3$ (25 ppm) | 60.82 | 69.45 | 102.91 |
| $T_5$ | $GA_3$ (50 ppm) | 60.71 | 67.55 | 99.39 |
| $T_6$ | $GA_3$ (75 ppm) | 59.00 | 66.39 | 96.03 |
| $T_7$ | B as borax (1.0%) | 63.07 | 69.24 | 106.01 |
| $T_8$ | B as borax (1.5%) | 61.63 | 68.66 | 106.00 |
| $T_9$ | B as borax (2.0%) | 60.89 | 68.35 | 105.96 |
| $T_{10}$ | Urea (0.5%) + $GA_3$ (25 ppm) | 61.01 | 68.02 | 102.37 |
| $T_{11}$ | Urea (1.0%) + $GA_3$ (50 ppm) | 65.82 | 68.24 | 103.39 |
| $T_{12}$ | Urea (1.5%) + $GA_3$ (75 ppm) | 65.50 | 68.49 | 105.26 |
| $T_{13}$ | Urea (0.5%) + $GA_3$ (25 ppm) + B as borax (1%) | 60.08 | 67.74 | 101.89 |
| $T_{14}$ | Urea (0.5%) + $GA_3$ (50 ppm) + B as borax (1.5%) | 60.41 | 67.16 | 98.58 |
| $T_{15}$ | Urea (0.5%) + $GA_3$ (75 ppm) + B as borax (2%) | 58.03 | 65.15 | 94.00 |
| $T_{16}$ | Control | 65.82 | 74.66 | 106.20 |
| | S.E. ± | 0.63 | 0.78 | 0.97 |
| | C.V. % | 1.74 | 1.94 | 1.63 |
| | C.D. (P=0.05) | 1.81 | 2.25 | 2.79 |

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