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Influence of Growth Stimulants on Seed Germination of Bird's Eye Chilli (*Capsicum frutescens* L.)

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ABSTRACT

An investigation was conducted at College of Horticulture, Mudigere during the year 2022-23 to study the effect of plant growth stimulants on seed germination of bird's eye chilli. The statistical design adopted for seed germination study was Completely Randomized Design with fourteen treatments. Among the different treatments, the seeds treated with T_4 (Thiourea @ 2 %) recorded significantly minimum days taken for germination (14.68) and maximum number of leaves (5.30). The seeds treated with T_{11} (GA_3 @ 50 ppm) recorded significantly maximum germination percentage (91.65 %) and seedling vigour index (840.43). While, seeds treated with T_{12} (GA_3 @ 100 ppm) recorded significantly maximum shoot length (5.26 cm), root length (5.18 cm), fresh weight of shoot (0.24 g), dry weight of shoot(0.032 g), number of primary roots (14.00), secondary roots (10.69) and seedling length (10.44 cm). The results revealed that soaking the seeds in GA_3 @ 50 ppm would help improve seed germination in bird's eye chilli.

Key words: *Bird's eye chill, GA_3, Thiourea and Seed germination.*

Introduction

Bird's eye chilli (*Capsicum frutescens* L.) is considered as one of the emerging spice crops. As a vegetable and spice, it plays a significant role in everyone's daily lives in tropical countries around the world.It belongs to the family Solanaceae with the chromosome number 2n = 24 and is native to Tropical America and Guatemala is the secondary centre of origin. The crop was introduced into India by Portuguese in the later part of the 16th century. Peppers are considered the first spice to have been used by human beings and there is archaeological evidence of pepper and other fossil foods from as early as 6000 years ago (Hill *et al*., 2013). Bird's eye chilli is called by many other synonyms like African pepper, chilli pepper, goat's pod, Mexican chilli, red pepper, Tabasco pepper, Zanzibar pepper and Cayenne pepper whose small, very pungent fruits separates easily from calyx. The name bird's eye chilli because, birds love to pick the ripe fruits.

Bird's eye chilli (*Capsicum frutescens* L.) seeds remain viable for only 2-3 years. But its hard seed coat hinders its germinability. Seed germination and seedling growth are regulated by endogenous level of hormones. Hence, to overcome the dormancy problem and also to enhance the germination, exogenous application of hormone was attempted. A

([1]PG Scholar, [2]Assistant Professor, [3]Assistant Professor, [4]Assistant Professor, [5] Scientist) number of chemicals have been recorded which break dormancy or helps in germination. To produce quality seeds, timely harvest is crucial to maximize seed vigour and germination. Visual indicators of physiological maturity have been used as an indicator of seed maturity. Apart from seed maturity, germination dynamics such as percentage, rate and vigour are greatly influenced by the characteristics of the seed that determines the conditions required for germination.

Major constraint in production of chilli is unavailability of high-quality seeds and seeds show erratic physiological maturity with low germination and vigour. Hence an attempt has been made to know the suitable growth stimulants on seed germination and vigour of bird's eye chilli.

Materials and Methods

The experiment was carried out at the Department of Plantation, Spices, Medicinal and Aromatic Crops. College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvakki, Shivamogga, Karnataka, during 2022- 2023. The experiment was laid out in Completely Randomized Design (CRD) with fourteen treatments and two replications.

Treatment details

The experiment consisted of chemicals and plant growth regulators involving 14 treatment and one water soaking and a control. The seeds were soaked for 30 minutes for treatment number 1 to 12 and treatment number 13 seeds were soaked for 8 hours.

T_1: KNO_3 @ 0.25 per cent
T_2: KNO_3 @ 0.50 per cent
T_3: Thiourea @ 1 per cent
T_4: Thiourea @ 2 per cent
T_5: HCl @ 0.25 per cent
T_6: HCl @ 0.50 per cent
T_7: Humic acid @ 1 per cent
T_8: Humic acid @ 2 per cent
T_9: NAA @ 75 ppm
T_{10}: NAA @ 100 ppm
T_{11}: GA_3 @ 50 ppm
T_{12}: GA_3 @ 100 ppm
T_{13}: Water soaking
T_{14}: Control

Germination per cent

Germination percentage was calculated by using the fallowing formula

$$\text{Germination (\%)} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

Seedling vigour index

The seedling vigour index was calculated by adopting the method suggested by Abdul and Anderson (1973) and values are expressed in numbers.

Seedling vigour index-I = Germination (%) × Mean seedling length (cm)

Results and Discussion

Among the treatments, the treatment T_4 (Thiourea @ 2 %) recorded significantly minimum days taken for germination (14.68). While, T_{14} (Control) took maximum days for germination (20.26). This might be due to the fact that thiourea plays a vital role in speeding up the germination of chilli seeds. It stimulates the activity of certain enzymes involved in germination processes, such as amylase and protease, those responsible for breaking seed dormancy and mobilizing stored nutrients during germination. Similar findings were also reported by Desai *et al*. (1987) and Solanki and Joshi (1985) in chilli.

Maximum germination percentage (91.65 %) was noticed in the treatment T_{11} (GA_3 @ 50 ppm). Whereas, T_{14} (Control) recorded the least germination percentage (45.00 %). This might be attributed to gibberellic acid which helps in breaking seed dormancy and stimulates the production of specific enzymes, such as α-amylase, which are responsible for breaking down starches in the endosperm into simple sugars. These sugars serve as a source of energy for the growing embryo during germination. Similar findings were also reported by Chauhan *et al*. (2017) and Khaba *et al.* (2020) in chilli.

The seeds treated with GA_3 @ 100 ppm (T_{12}) showed significantly maximum shoot length (5.26 cm) and root length (5.18 cm), while treatment T_{14} (Control) recorded minimum shoot length (3.25 cm) and root length (1.62 cm). Increase in shoot and root length might be due to promotion of cell elongation by loosening the cell wall structure by gibberellic acid. It activates enzymes that break down the bonds between cellulose microfibrils in the cell walls, allowing the cells to expand and elongate. This process is particularly important for the growth of shoots and roots. Similar findings were reported by Sharma *et al.* (2015); Chauhan *et al.* (2017), Tombegavani *et al.* (2020) in chilli.

Significantly maximum number of primary and secondary roots (14.00 and 10.69) were recorded with GA_3 @ 100 ppm. The least number of primary and secondary roots (3.20 and 0.78) were noticed in T_{14} (Control). This might be due to increase in root length which helps for development of more number of primary and secondary roots. Gibberellic acid promotes cell division and elongation in the root meristem, which is the region of actively dividing cells at the tip of the root. This leads to the formation of new cells and the subsequent growth of primary roots. These findings are also supported by Sharma *et al.* (2015) and Chauhan *et al.* (2017) in chilli.

Among various growth stimulants, the seeds treated with treatment GA_3 @ 100 ppm (T_{12}) recorded maximum fresh weight (0.24 g) of shoot and dry weight (0.032 g) of shoot. However, minimum fresh weight (0.11 g) and dry weight (0.014 g) of shoot was recorded in treatment T_{14} (Control). This might be due to the fact that gibberellic acid helps to increase shoot length and more number of leaves per seedling, contributing to higher fresh weight of shoot. Due to maximum fresh weight which ultimately resulted in increased dry weight of shoot. The present findings are in consonance with the findings of Sharma *et al.* (2015) and Tombegavani *et al.* (2020) in chilli.

Among various growth stimulants, the seeds treated with GA_3 @ 100 ppm recorded maximum fresh weight (0.068 g) and dry weight of root (0.027 g) However, minimum fresh weight (0.037 g) and dry weight (0.007 g) of root was recorded in T_{14} (Control). This was probably due to promotion of cell elongation and division by gibberellic acid leading to increased root length and mass. This could result in greater fresh weight due to longer roots and potentially more cells, which can then lead to an increase in dry weight. The results are in agreement with the findings of Yogananda *et al.* (2004) and Kabilan *et al.* (2022) in chilli.

Treatment with GA_3 @ 100 ppm also resulted in significantly maximum seedling length (10.44 cm). Maximum seedling vigour index (840.43) was recorded in treatment T_{11} (GA_3 @ 50 ppm). While, treatment T_{14} (Control) recorded minimum seedling length (4.87 cm) and seedling vigour index (283.92). Increased seedling length and its growth might be due to increase in cell

Table 1. Effect of growth stimulants on germination and seedling growth parameters of bird's eye chilli in nursery at 45 DAS

Treatments	Days taken for germination	Germination Percentage	Shoot length (cm)	Root length (cm)	Number of primary roots per seedling	Number of secondary roots per seedling	Fresh weight of shoot (g)	Dry weight of shoot (g)	Seedling length (cm)	Seedling vigour index
T_1: KNO_3 @ 0.25 %	16.35	66.65	3.37	1.77	4.10	1.76	0.18	0.019	5.14	342.58
T_2: KNO_3 @ 0.50 %	17.80	71.60	3.83	2.59	5.20	1.24	0.16	0.017	6.42	459.67
T_3: Thiourea @ 1 %	16.59	48.30	4.67	2.13	7.10	1.80	0.18	0.026	6.80	328.44
T_4: Thiourea @ 2 %	14.68	69.95	4.28	4.12	13.90	7.92	0.22	0.029	8.40	587.58
T_5: HCl @ 0.25 %	17.85	65.00	4.48	2.68	11.40	3.56	0.19	0.023	7.16	465.40
T_6: HCl @ 0.50 %	19.66	63.30	3.55	2.63	5.70	0.82	0.15	0.016	6.18	391.19
T_7: Humic acid @ 1 %	15.29	66.45	4.04	2.80	4.10	0.82	0.17	0.023	6.84	454.51
T_8: Humic acid @ 2 %	18.03	68.30	3.32	3.23	8.10	2.75	0.16	0.016	6.55	447.36
T_9: NAA @ 75 ppm	19.61	53.30	3.51	2.94	6.00	2.40	0.13	0.015	6.45	343.78
T_{10}: NAA @ 100 ppm	16.08	73.30	3.96	3.82	5.90	3.66	0.20	0.027	7.78	570.27
T_{11}: GA_3 @ 50 ppm	15.70	91.65	4.59	4.58	10.10	3.83	0.15	0.020	9.17	840.43
T_{12}: GA_3 @ 100 ppm	17.01	68.00	5.26	5.18	14.00	10.69	0.24	0.032	10.44	709.92
T_{13}: Water soaking	16.11	58.30	3.51	2.94	6.30	2.06	0.16	0.020	6.45	290.25
T_{14}: Control	20.26	45.00	3.25	1.62	3.20	0.78	0.11	0.014	4.87	283.92
S. Em±	0.29	3.10	0.15	0.14	0.43	0.08	0.01	0.002	0.32	4.80
CD @ 1%	1.23	13.06	0.62	0.59	1.80	0.34	0.04	0.01	1.37	20.20

elongation at the apical meristem of shoots and roots. The present results are in line with those of Rehman *et al*. (2007). Increase in seedling vigour might be due to maximum seedling length and germination percentage. Also, gibberellic acid has been reported to result in higher rate of metabolic activity and respiration, better utilization and mobilization of metabolites to growing points which results in higher vigour of seedlings (Kumar *et al.*, 2014). The present results are in line with those of Sharma *et al.* (2015), Chauhan *et al*. (2017) and Kabilan *et al.* (2022)

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Conflict of interest

The authors declare that no conflict of interest exists.

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