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EFFECT OF PLANT GROWTH REGULATORS ON QUALITATIVE, GROWTH, YIELD AND ITS ATTRIBUTING TRAITS IN PEA (*PISUM SATIVUM* L.)

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ABSTRACT

The research conducted at the Chamelti Agriculture Farm, MS Swaminathan School of Agriculture, Shoolini University of Biotechnology and Management Sciences, Solan, H.P., India; during the *Rabi* seasons of 2021-22 aimed to investigate the impact of various plant growth regulators on the yield and related traits of PB-89 variety of pea (*Pisum sativum* L.). The experiment employed a randomized block design with nine treatments, including water soaking, GA_3 at different concentrations, and combinations with Cycocel at varying concentrations. Significant findings include the positive effect of GA_3 at 200 ppm (T_3) on plant height, comparable to GA_3 at 100 ppm (T_2) and GA_3 at 200 ppm with Cycocel at 200 ppm (T_8). Additionally, foliar sprays of CCC 400 ppm with water soaking treatment (T_5) significantly increased the number of primary branches per plant. Seed treatment with GA_3 at 200 ppm followed by foliar spray of CCC 200 ppm (T_8) significantly increased the number of nodes per plant. Water soaking of seeds followed by foliar sprays of CCC 200 ppm (T_4) exhibited superior performance in terms of first flower position, days to first flowering, and days to 50% flowering. Yield attributing characters such as pod length, pod diameter, pod weight, number of pods per plant, number of seeds per pod, pod and seed yield were notably higher under the application of GA_3 at 200 ppm followed by foliar spray of Cycocel at 200 ppm (T_8). Quantitatively, seed soaking under GA_3 at 200 ppm (T_3) resulted in higher germination percentage and seed vigor index. However, water soaking with Cycocel at 400 ppm (T_5) showed higher total soluble solids, ascorbic acid, and crude protein content. This study suggests that the application of GA_3 at 200 ppm followed by foliar spray of Cycocel at 200 ppm significantly improves pea yield attributes and overall yield, presenting a promising approach for enhancing pea productivity.

Key words : Cycocel, Foliar Spray, Plant Growth Regulators, Productivity

Introduction

Pea (*Pisum sativum* L.) stands out as a significant pulse and leguminous vegetable crop, recognized by various names worldwide, including field pea, garden pea, green pea, yellow pea, smooth pea and wrinkled pea, widely utilized for both human and animal consumption (Tulbek *et al.*, 2017). Belonging to the Fabaceae family, it is a self-pollinated diploid (2n = 14) annual cool-season pulse crop (McKay *et al.*, 2003). Cultivated in Central Asia, particularly in northwest India and Afghanistan, pea holds considerable economic importance in Asia, Africa, Japan and subtropical regions (Gurjinder and Kashyap, 2018). Renowned for its versatility, pea is a vital crop consumed either as fresh produce or in canned form. Furthermore, when fully mature, it serves as a nutritious food item, often ground into flour and extensively used in soup manufacturing. Fresh green pea is universally acknowledged as a wholesome vegetable (Rezene *et al*., 2015). Termed "poor man's meat" due to its richness in protein, vitamins, minerals and prebiotic carbohydrates, pea holds nutritional significance (Amarakoon *et al*., 2012; Kandel *et al*., 2016).

Dried peas exhibit a protein content ranging from 18 to 28.4%, with 60.7% carbohydrates, 1.4% crude fiber, 1.4% fat and 2.7% ash (Hulse, 2000). Green peas are rich in vitamins A, B and C, along with essential minerals, riboflavin, and carotene. This versatile legume is a staple in the daily culinary endeavors of housewives, contributing to the preparation of flavorful and savory dishes. Typically chopped and incorporated into various recipes, peas boast small spherical seeds or pods, and they are characterized as annual herbaceous plants with well-developed taproot systems. The plant features slender lateral branches, an angular or round stem, compound non-pigmented leaves, and fistular structures with 1-3 pinnate ovals measuring 25-50 mm in length and ending in micronate tips. The auxiliary inflorescence, with a long stalk, forms clusters of 12 flowers, each with 10 anthers in a diadelphous condition. Pods, variable in length and width may be curved or straight and typically contain 4-10 seeds per pod, depending on the cultivar. Peas thrive in cooler temperate zones and highlands of tropical regions worldwide. Additionally, pea cultivation spans a broad spectrum of soil types, ranging from light sandy loams to heavy clays, with an optimal soil pH of 5.5-6.5.

Globally, China holds the leading position in pea production, reaching 11,250.37 thousand metric tons in 2020, followed by India with a production of 5,703 thousand metric tons (Anonymous, 2020). In India, peas are cultivated across an area of 0.56 million hectares, resulting in a production of 0.64 million tons (Anonymous, 2021). The key pea-growing states in India include Uttar Pradesh, Madhya Pradesh, Jharkhand, Punjab, Himachal Pradesh, West Bengal, Haryana, Bihar, Uttarakhand, Orissa and Karnataka. Himachal Pradesh secures the fifth rank in India, producing a total of 294.96 thousand metric tonnes during the 2017-2018 period (Anonymous, 2018), with the production reaching 0.03 million tonnes from an area of 26.00 hectares in 2021 (Anonymous, 2021).

Peas are commonly integrated into forage crop mixtures with small grains (Kindie *et al*., 2019). Notably, trypsin inhibitors in peas are lower than those in soy, enabling cattle to feed directly without the need for squeezing and heating. Peas also find utility as green manure or green fallow crops. When used in rotation, stimulated volunteer plants that follow a main pea crop contribute to a high number of *Rhizobium leguminosarum* bacteria inoculums in the soil, leading to excellent nodulation and enhanced soil fertility (Fikere *et al*., 2014). These bacteria play a crucial role in nitrogen fixation, converting molecular nitrogen (N_2) into ammonia (NH_3). Consequently, they contribute to soil texture improvement, soil water conservation, and the reduction of microbial variations (Biederbeck *et al*., 2005; Chen *et al*., 2006).

While many developing countries face ongoing concerns about well-tested and proven security enhancements, the primary objective remains enhancing productivity to provide sustenance for millions of people. In the agricultural domain, a recent advancement focused on improving crop production involves the utilization of plant growth regulators (PGRs). These substances, naturally synthesized in plants, impact various physiological processes, and their synthetic counterparts activate numerous biochemical and physiological mechanisms associated with plant growth and development (Bagher *et al*., 2021). Plant growth regulators play a pivotal role in enhancing the physiological efficiencies of plants, encompassing root growth, increasing flower count, augmenting fruit size, inducing early and uniform fruit ripening, boosting photosynthetic capacity and ultimately achieving higher yields. They also contribute to improving the source-sink relationship, facilitating the movement of photometabolites, and thereby enhancing overall productivity.

Certain PGRs, such as gibberellic acid (GA_3), have demonstrated the ability to stimulate cell elongation, advance plant maturity and influence parameters like pod count per plant, pod and seed weight (Khan *et al*., 2002; Bora and Sarma, 2003; Rahman *et al*., 2004; Pandey *et al*., 2004; Chaurasiya *et al*., 2014; Jagadeesha *et al*., 2015). Conversely, Cycocel (CCC), a synthetic growth inhibitor, is widely utilized to stunt the growth of plant parts and entire plants (Bora and Sarma, 2004). The recent increase in pea acreage has resulted in a significant shortage of seed supply, creating a notable imbalance between production and the overall demand for seeds. To tackle this challenge and bridge the gap in seed supply and demand, immediate measures are imperative to augment both the quantity and quality of seed per unit area. Enhancing seed yield per unit area is critical for sustaining agricultural productivity and meeting the escalating demand for seeds.

Materials and Methods

The experimental phase took place during the *rabi* season of 2021-22 at the Chamelti Agriculture Farm, located within the MS Swaminathan School of Agriculture at Shoolini University of Biotechnology and Management Sciences, Solan. H.P., India. Geographically, Chamelti Agriculture Farm is positioned 30 km away from Solan city, situated at an elevation of 1,270 meters above mean sea level. Its coordinates fall between latitude 30p 85'67.30 N and longitude 77p 13'20.38 E, placing it within the mid-hill zone of Himachal Pradesh. For the experimentation, a randomized block design was employed, incorporating nine treatments. The assignment of treatments to experimental units followed a random process using the Fisher and Yates random table method (Panse and Sukhatme, 1985) and was replicated thrice for statistical robustness. Table 1 provides a comprehensive overview of the treatments and corresponding symbols used in the experiment.

Table 1 : Treatment details.

S. no.	Treatments	Symbols
1.	Water soaked	T_1
2.	GA_3 100 ppm	T_2
3.	GA_3 200 ppm	T_3
4.	Water soaked + Cycocel 200 ppm	T_4
5.	Water soaked + Cycocel 400 ppm	T_5
6.	GA_3 100 ppm + Cycocel 200 ppm	T_6
7.	GA_3 100 ppm + Cycocel 400 ppm	T_7
8.	GA_3 200 ppm + Cycocel 200 ppm	T_8
9.	GA_3 200 ppm + Cycocel 400 ppm	T_9

PB-89 variety of pea developed by Punjab Agricultural University, Ludhiana, Punjab in the year of 2015 for cultivation of North Western Plain Zones/Punjab. It is resistant to rust and average yield potential of 14-16 Q ha^{-1}. It matures in about 120 days.

Results and Discussion

The results obtained on growth characters, flowering and fruit set characters, yield-attributes, yield and qualitative traits of pea as influenced by different treatments are briefly discussed and interpreted in the light of findings of research work already done by the scientist in our country and abroad. It is necessary to follow plant growth regulators for higher production of pea. The results are discussed and interpreted critically in this chapter under appropriate heads.

Effect of plant growth regulators on growth characters

Data on growth traitsas influenced by the various plant growth regulators presented in Table 2. Application of plant growth regulators inhibit the plant height. Application of GA_3 enhanced plant height while, CCC was retard. Significantly higher plant height was recorded with seed treatment of pea through GA_3 200 ppm (T_3) which was statistically at par with GA_3 100 ppm (T_2) and GA_3 200 ppm + CCC 200 ppm (T_8).

From this study, it is observed that GA_3 has increased the plant height, whereas CCC had reduced the same. These findings are also similar with study of Emongor (2007), where they concluded that GA_3 significantly increased the plant height but cycocel reduced the same in pea crop. Treatment with GA_3 resulted in an observed increase in plant height, aligning with findings from various researchers who have similarly concluded that GA_3 may be responsible for boosting photosynthetic activity, hastening translocation and improving the efficiency of utilizing photosynthetic products. Consequently, this leads to heightened cell elongation and accelerated cell division in the growing portion of the plant. The height of the plant is a visible measurement of growth and is a function of the internodal elongation and the increasing number of nodes $plant^{-1}$. The emergence of the leaves on the stem, the development of the leaf and the biomass show close relationship with plant height Dhage *et al.* (2011) and Ayyub *et al.* (2013). Foliar application of GA_3 increased the height of the pea plant by increasing internodal length due to cell division, cell enlargement and apical dominance perhaps by increasing the auxin level of the tissue or increasing the conversion of tryptophan to IAA (Emongor, 2007). The results are in agreement with Mohandoss and Rajesh (2003), Thaware *et al.* (2006), in green gram, Natesh *et al.* (2005) and Singh *et al.* (2015) in garden pea.

The foliar sprays of CCC 400 ppm with water soaking treatment (T_5) was recorded significantly higher number of primary branches $plant^{-1}$ over rest of the treatments. The outcomes align with the discoveries of Kothule *et al.* (2003) and Kumar *et al.* (2002), who similarly observed and concluded that the increase in the number of branches induced by CCC could be attributed to the inhibition of apical bud dominance and the breaking of lateral bud dormancy. This effect may be a result of the application of the plant growth regulator, enhancing improved physiological processes and nutrient uptake, consequently leading to an increased number of branches. These findings closely correspond with the research conducted by Paikra *et al.* (2017).

Table 2 : Plant height (cm), number of primary branches plant^{-1} and nodes plant^{-1} of pea influenced by plant growth regulators at 50% flowering.

Treatments	Plant height (cm)	Primary branches plant^{-1}	Number of nodes plant^{-1}	No. of nodes at first flowering initiated	Days to first flowering	Days to 50% flowering	Days to first picking
T_1: Water soaked	60.63	1.43	13.03	10.43	91.33	95.00	128.67
T_2: GA_3 100 ppm	77.60	1.67	13.93	10.53	98.67	101.33	131.00
T_3: GA_3 200 ppm	80.70	1.83	15.47	9.97	102.00	104.00	131.67
T_4: Water soaked + Cycocel 200 ppm	67.53	2.13	13.93	9.50	90.00	93.67	127.33
T_5: Water soaked + Cycocel 400 ppm	63.20	2.77	13.64	9.77	90.33	94.00	127.67
T_6: GA_3 100 ppm + Cycocel 200 ppm	73.53	1.97	15.93	10.47	97.67	100.67	130.33
T_7: GA_3 100 ppm + Cycocel 400 ppm	70.37	2.13	15.60	10.90	100.00	102.67	129.00
T_8: GA_3 200 ppm + Cycocel 200 ppm	75.67	2.33	16.34	11.33	100.33	103.00	130.67
T_9: GA_3 200 ppm + Cycocel 400 ppm	73.70	2.47	16.05	11.07	100.67	103.33	131.33
SE(m)±	**2.24**	**0.04**	**0.02**	**0.36**	**2.05**	**1.75**	**0.75**
LSD (p = 0.05)	**6.79**	**0.11**	**0.07**	**1.09**	**6.19**	**5.29**	**2.28**

Significantly higher number of nodes plant^{-1} was recorded with application of (T_8) seed treatment of GA_3 200 ppm followed by foliar spray of CCC 200 ppm which showed superiority over rest of the treatments. This could be attributed to cell elongation and cell division, leading to an increase in both the number and length of internodes. Consequently, GA_3 plays a crucial role in enhancing the mean number of internodes per plant. Consistent findings of an increase in the mean number of internodes per plant through the application of GA_3 in peas were reported by Jadhav (2000), Sarkar *et al.* (2002), Banerjee *et al.* (2011), Ramesh *et al.* (2013), Upadhyay and Rajan (2015).

Effect of plant growth regulators on flowering and fruit set

Data on flowering and fruit setas influenced by the various plant growth regulators presented in Table 2. Among the treatments, (T_4) water soaking of seeds followed by foliar sprays of CCC 200 ppm was significantly exhibited first flower on lower nodal position, days to first flowering and days to 50% flowering were found superior over rest of the treatments but was statistically at par with (T_5) Water soaked + foliar application of cycocel 400 ppm and (T_3) seed soaked under GA_3 200 ppm solution. The earlier flowering observed in the growth regulator treatments, in comparison to the control, could be attributed to the suppression of vegetative growth. This suppression results in a reduced demand for food materials synthesized by the treated plant. Consequently, the accumulation of excessive carbohydrate reserves may have induced early flowering and accelerated the reproductive phase of the plant. These outcomes align with the findings of Kothule *et al.* (2003), Shinde *et al.* (2010) and Pushpendra (2014).

Significantly earliness in days to first picking was observed under application of (T_4) water soaked with seed followed by foliar spray of CCC 200 ppm which was statistically at par with (T_5) Water soaked + Cycocel 400 ppm, (T_1) water soaked and (T_7) seed treatment of $GA_3$100 ppm followed by foliar spray of CCC 400 ppm over rest of the treatments. The application of CCC increased the synthesis of specific endogenous growth substances, initiating metabolic processes and narrowing down the carbon-nitrogen ratio in the plant. This, in turn, stimulated early pod maturity. Comparable results indicating earlier flower initiation were reported by Resmi and Gopalkrishnan (2004) and Bramhankar *et al.* (2018).

Effect of plant growth regulators on yield attributes and yield

Data on yield attributes and yield as influenced by the various plant growth regulators presented in Table 3. Significantly higher pod length, pod diameter and pod weight were recorded under application of (T_8) GA_3 200 ppm followed by foliar spray of Cycocel 200 ppm which was statistically at par with (T_9) GA_3 200 ppm followed by foliar spray of CCC 400 ppm, (T_6) GA_3 100 ppm + Cycocel 200 ppm and (T_7) GA_3 100 ppm + Cycocel 400 ppm over rest of the treatments. The observed outcomes can be primarily attributed to the stimulatory impact of GA_3 on plant growth, leading to elevated rates of biosynthesis and, consequently, increased amounts of assimilates available for distribution to the pods. Comparable results have been reported in pea by Patil and Patel (2010), Ayyub *et al*. (2013) and Singh *et al*. (2015).

Analyzed data shows that significantly higher number of pods plant^{-1} were recorded under application of (T_8) GA_3 200 ppm + foliar spray of CCC 200 ppm which was statistically at par with (T_9) GA_3 200 ppm + CCC 400 ppm, (T_6) GA_3 100 ppm + CCC 200 ppm, (T_7) GA_3 100 ppm + CCC 400 ppm, (T_2) GA_3 100 ppm and (T_3) GA_3 200 ppm over rest of the treatments. The increase in number of pods plant^{-1} by growth regulator treatments may probably due to increase in flower and pod setting percentage. The combined application of GA_3 and CCC demonstrated the most effective impact. It is evident that GA_3 and CCC have the potential to increase the pod count, attributed to the maximum number of flowers and branches, resulting in the highest number of pods per plant. This could be due to a synergistic effect resulting from the interaction between GA_3 and CCC, enhancing the number of pods per plant. Comparable results, indicating a higher number of pods per plant, were reported by Bora and Sarma (2003 and 2006) in peas, Emongor (2007) in cowpea and Agawane *et al*. (2015).

Significantly higher number of seeds pod^{-1} was recorded under application of (T_8) GA_3 200 ppm + foliar spray of CCC 200 ppm which was statistically at par with (T_9) GA_3 200 ppm + CCC 400 ppm, (T_6) GA_3 100 ppm + CCC 200 ppm and (T_7) GA_3 100 ppm + CCC 400 ppm over rest of the treatments. The number of seeds pod^{-1} may be increased because of the fact that there might be a synergetic effect of the interaction due to the combination of both growth regulators. These findings align with those of Upadhyay (2002) in chickpeas, Ngatia *et al*. (2004) in common beans and El-Shraiy and Hegazi (2009) in peas. Conversely, regardless of its concentration, CCC yielded a greater number of seeds per pod compared to the control. This could be attributed to the restraint of vegetative growth by CCC, resulting in improved seed setting. Similar results were reported by Upadhyay (2002)

Table 3 : Pod length (cm), pod diameter (cm), pod weight (g), number of pods plant^{-1}, seeds pod^{-1}, pod yield plant^{-1}ha^{-1} (q), seed yield plant^{-1} (g), ha^{-1} (q) and 100-seed weight (g) of pea influenced by plant growth regulators.

Treatments	Pod length (cm)	Pod diameter (cm)	Pod weight (g)	Number of pods plant^{-1}	Number of seeds pod^{-1}	Pod yield plant^{-1}(g)	Pod yield ha^{-1}(q)	Seed yield plant^{-1}(g)	Seed yield ha^{-1} (q)	100-seed weight (g)
T_1 : Water soaked	7.0	0.95	4.75	12.73	7.59	80.10	13.22	32.30	5.33	18.25
T_2 : GA_3 100 ppm	7.8	1.04	6.22	14.53	8.50	84.65	13.97	35.17	5.80	19.82
T_3 : GA_3 200 ppm	8.4	0.99	6.69	14.53	8.50	85.09	14.04	36.02	5.94	19.85
T_4 : Water soaked + Cycocel 200 ppm	7.1	0.91	5.20	14.27	8.10	84.65	13.97	35.17	5.80	19.44
T_5 : Water soaked + Cycocel 400 ppm	7.0	0.88	5.17	14.17	8.50	81.34	13.42	33.60	5.54	19.16
T_6 : GA_3 100 ppm + Cycocel 200 ppm	8.9	1.08	7.35	15.10	9.47	87.92	14.51	37.74	6.23	20.50
T_7 : GA_3 100 ppm + Cycocel 400 ppm	8.7	0.97	6.93	14.73	9.43	86.33	14.24	36.27	5.98	20.22
T_8 : GA_3 200 ppm + Cycocel 200 ppm	9.9	1.18	7.41	15.87	10.07	90.53	14.94	38.10	6.29	22.58
T_9 : GA_3 200 ppm + Cycocel 400 ppm	9.1	1.11	7.37	15.20	9.70	90.23	14.89	38.07	6.28	21.47
SE(m)±	**0.4**	**0.02**	**0.13**	**0.47**	**0.42**	**0.36**	**0.36**	**0.31**	**0.04**	**0.82**
LSD (p = 0.05)	**1.3**	**0.07**	**0.40**	**1.44**	**1.26**	**1.09**	**1.10**	**0.94**	**0.11**	**NS**

Table 4 : Germination (%), seed vigour index-I and II, total soluble solid (°B), ascorbic acid (mg/100 g fresh weight) and crude protein content (%) of pea influenced by plant growth regulators.

Treatments	Germination (%)	Seed vigour index-I	Seed vigour index-II	Total soluble solid (°B)	Ascorbic acid (mg/100 g fresh weight)	Crude protein content (%)
T_1: Water soaked	81.30	2085.28	70.54	16.83	16.08	15.16
T_2: GA_3 100 ppm	88.15	2443.30	81.68	16.40	14.85	16.34
T_3: GA_3 200 ppm	89.75	2451.85	82.73	15.70	16.11	16.89
T_4: Water soaked + Cycocel 200 ppm	84.18	2336.64	74.30	17.30	14.24	17.73
T_5: Water soaked + Cycocel 400 ppm	83.75	2311.32	73.27	17.60	17.20	16.39
T_6: GA_3 100 ppm + Cycocel 200 ppm	85.95	2381.36	76.38	16.70	14.17	18.22
T_7: GA_3 100 ppm + Cycocel 400 ppm	85.12	2351.44	75.39	15.40	14.93	18.21
T_8: GA_3 200 ppm + Cycocel 200 ppm	87.08	2422.24	79.31	16.47	14.80	17.89
T_9: GA_3 200 ppm + Cycocel 400 ppm	86.82	2406.69	78.69	15.17	15.13	17.36
SE(m)±	**1.25**	**33.98**	**2.36**	**0.18**	**0.12**	**0.07**
LSD (p = 0.05)	**3.78**	**102.75**	**7.16**	**0.06**	**0.35**	**0.21**

in chickpeas and Emongor (2007) in cowpeas.

The significantly higher pod and seed yield was recorded under application of (T_8) GA_3 200 ppm + foliar spray of CCC 200 ppm which was statistically at par with (T_9) GA_3 200 ppm + CCC 400 ppm and (T_6) GA_3 100 ppm + CCC 200 ppm over rest of the treatments. The increase in seed yield is the manifestation of increased number of branches, pod number plant^{-1}, seed number pod^{-1} and seed weight plant^{-1} due to application of plant growth regulators such as GA and CCC at different concentrations. Similar results of increase in yield by application of plant growth regulators were reported by Bora and Sarma (2005) in pea, Emongor (2007) in cowpea and Agawane *et al*. (2015).

Effect of plant growth regulators on qualitative traits

Data on qualitative traitsas influenced by the various plant growth regulators presented in Table 4. Germination capacity of seed lot indicates its ability to establish seedling under good field conditions which was significantly increased by the application of growth regulators tabulated in Table 4. Significantly higher germination was observed under (T_3) seed soaked under GA_3 solution of 200 ppm which was statistically at par with (T_2) GA_3 100 ppm, (T_8) GA_3 200 ppm + foliar spray of CCC 200 ppm and (T_9) GA_3 200 ppm + CCC 400 ppm over rest of the treatments. Similar results were obtained by Patil (2003) in cluster bean.

Seedling vigour index is the resultant effect of germination percentage and average length of root and shoot. It was observed that plant growth regulators had significant effect on seedling vigour index. Among the treatments, significantly higher seed vigour index-I and seed vigour index-II was recorded under (T_3) seed soaked under GA_3 solution of 200 ppm, which was statistically at par with all the treatments except for (T_1) water soaked, (T_4) water soaked + Cycocel 200 ppm and (T_5) water soaked + Cycocel 400 ppm. This might be due to increase in germination percentage and increased root-shoot length by application of GA_3. Similar results of increased seedling vigour index by using GA_3 were reported by Thaware *et al.* (2006) in green gram, Singh *et al.* (2015) in pea and Golakiya *et al.* (2017) in cowpea.

Among the treatments, significantly higher total soluble solid, ascprbic acid and crude protein content were recorded under application of (T_5) water soaked + Cycocel 400 ppm over rest of the treatments. This could be due to the application of plant growth regulators (GA_3) that stimulated and enhanced enzymatic activities through its effect on natural hormones that accelerated plant growth and development. The results are in agreement with Tavelu *et al.* (2018)in pea.

Conclusion

Marked improvement in yield attributes and yield of pea were observed with application of (T_8) GA_3 200 ppm followed by foliar spray of Cycocel 200 ppm and was at par with (T_9) GA_3 200 ppm followed by foliar spray of CCC 400 ppm, (T_6) GA_3 100 ppm + Cycocel 200 ppm and (T_7) GA_3 100 ppm + Cycocel 400 ppm over rest of the treatments. Quantitatively, seed soaking under GA_3 at 200 ppm resulted in higher germination percentage and seed vigor index. However, water soaking with Cycocel at 400 ppm showed higher total soluble solids, ascorbic acid and crude protein content. This study suggests that the application of GA_3 at 200 ppm followed by foliar spray of Cycocel at 200 ppm significantly improves pea yield attributes and overall yield, presenting a promising approach for enhancing pea productivity.

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