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Effect of Shoot Pruning and Growth Regulators on Yield, Quality and Marketability of Kiwifruit (*Actinidia deliciosa*) Cv. Allison

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ABSTRACT

An study was conducted by KVK, Bageshwar during 2021 at Sama village of Kapkot block of district Bageshwar to find out the suitability and efficacy of different crop regulating options of kiwifruit in farmer's perspective. The prime purpose of the study was to increase the yield of A grade fruits to maximize the returns. Four treatments (T1- No pinching and no use of plant growth regulators, T2- Pinching 20 percent growth at petal fall that continued till harvest at one month interval, T3- T2 + Fruit dipping at 20 days after full bloom in 50 ppm GA3 solution for 5 second,T4- T2 + Fruit dipping at 20 Days After Full Bloom in 50 ppm 2,4 D solution for 5 second) were applied for the assessment of various technologies. Pinching of 20 percent shoot growth at petal fall stage that continued till harvest at one month interval was found most appropriate. This practice gave 24 kg A grade fruits (>70 g) per vine, 17 kg B grade fruits (50-70 g) per vine and 7 kg C grade fruits (<50 g) per vine, while the farmer's practice (no pinching) resulted in 6 kg A grade fruits (>70 g) per vine, 13 kg B grade fruits (50-70 g) per vine and 21 kg C grade fruits (<50 g) per vine. The total soluble solid content (TSS°B) of fruits from pinching treatment was also higher (16.10 °B) than the fruits from no pinching vines (14.95 °B). Use of GA 3 (50 ppm) and 2,4 D (20 ppm) as fruit dip method at 20 days after full bloom (20 DAFB) could not further increase the grade A and B fruit yield significantly over pinching alone. Thus, Pinching of 20 percent shoot growth at petal fall stage that continued till harvest at one month interval is recommended for obtaining maximum quantity of "A"grade fruits that will successfully compete in market for better price.

Key Words: Days after full bloom (DAFB), Economic analysis, Fruit grading, Marketability and Shoot pruning.

INTRODUCTION

Kiwifruit (*Actinidia deliciosa*)is a dioecious vine having separate male and female plants with deciduous nature that require 700-800 chilling hours during dormancy for proper flowering and fruiting.Its fruits are exceptionally high in vitamin C and contain an array of other nutrients, notably nutritionally relevant levels of dietary fiber, potassium, vitamin E and folate, as well as various bioactive components, including a wide range of antioxidants, phytonutrients and enzymes, that act to provide functional and metabolic benefits**.** The enzyme actinidain present in kiwifruit helps in protein digestion also (Richardson *et al*, 2018). These nutritional benefits are making the kiwifruit a prime choice for the consumers. Its precocious bearing character, hardy nature, comparatively longer shelf life is making the kiwifruit a favorable fruit crop for the hill farmers. Even though, a recent introduction among the fruit crops, kiwifruit has occupied an area of 5000 ha with 16000 MT production (Anonymous. 2023) in India. But the major challenge of its successful marketing is fruit quality. Fruit size and taste are the two major characteristics that largely decide the fruit quality that eventually influences the fetching price. Chandel and Devi, 2010 also emphasized that profitable kiwifruit production depends upon the yield of good size fruits. Kiwifruits are graded on the basis of fruit weight. Fruits having > 70 g weight comes under A grade, while B grade fruits range from 50 g to 70 g and fruits below 50 g

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Glimpses of the experiment

weight are C grade fruits. A grade fruits are having bright marketing opportunities and they fetch highest prices, while B and C grade fruits grab low price and generally sold in local market and used for processing also.

The size of fruit depends on the number and size of cells and this is influenced by hormonal signals that originate in the developing seeds (Phillips, 2004).Manipulating fruit growth using both natural and synthetic exogenous plant growth regulators has been studied in several species by Petri *et al* (2001), Jindal *et al* (2003), Banyal *et al* (2013) and Thakur *et al*(2020).In addition to the role of plant growth regulators, competition between vegetative growth and fruiting greatly influences the fruit size and quality in kiwifruit (Rana *et al*, 2011).

Therefore, it is necessary to access the best intervention in the form of plant growth regulation in farmer's perspective that produces more proportion of A grade fruits with good blend of TSS and acidity for realizing the actual monetary benefits.

MATERIALS AND METHODS

The present study was conducted during 2021 at Sama village of Kapkot block of district Bageshwar situated at 29° 58' 54" N and 80° 01' 28" E and 1720 m amsl to find out the suitability and efficacy of different crop regulating options of kiwifruit in farmer's perspective. Ten years old kiwifruit plants of cv. Allision having almost same trunk girth and vine spread were selected for the experiment. Almost same winter pruning was also done and all the vines under experiment received same manure and fertilizers. There were four treatments *viz*., T 1- No pinching and no use of PGRs (Farmer's practice/ control), T 2- Pinching of 20 percent growth at petal fall that continued till harvest at one month interval, T3- T2 + Application of 50 ppm GA3 solution at 20 DAFB, T4 - T2 + Application of 50 ppm 2,4 D solution at 20 DAFB. The experiment was conducted in Randomized Block Design (RBD) with five replications and there was
one vine per plot.

After harvesting, fruits were graded manually in three grades (A Grade > 70g, B Grade- 50g- 70g and C Grade- < 50 g) by estimating the sorting size corresponding to weight of fruit. Observations were taken for individual yield of A, B and C grade fruits and total yield. The fruits were also tested for chemical quality attributes. The total soluble solid (TSS) content of fruits was measured by a digital refractometer (Extech Instrument, MI 722-01). Before taking sample appraisal, zero was set with distilled water and then for each sample a drop of juice was put at the designated place on the refractometer to get the reading. The acidity of fruits was estimated by titrating the fruit pulp extract with 0.1N NaOH using phenophthaline as indicator by applying the procedure described by Ranganna (1986). 10 g fruit sample was blend with small amount of distil water and filter into 100 ml volumetric flask. Final volume was made upto mark. Take 10 ml aliquot and titrate against 0.1N NaOH by using phenolphthalein as indicator. Mathematically, the titratable acidity was determined by using the following formula and was expressed as percentage malic acid.

$$\text{Titratable acidity (\%)} = \frac{\text{Titre value x 0.1 x 100 x equivalent weight of acid x 100}}{\text{Volume of aliquot taken x Weight of sample x 1000}}$$

TSS - Acid ratio was calculated by dividing the fruit TSS content with its corresponding acidity as mentioned below;

$$\text{T.S.S. - Acid ratio} = \frac{\text{T.S.S. (°Brix)}}{\text{Acidity (\%)}}$$

For calculating the real monetary benefits, cost of cultivation, gross income, net income and B:C were also calculated on real time as per the established methods.

RESULTS AND DISCUSSION

The data showed that the maximum total yield was obtained under T4 (48.5 kg/ Vine) that was statistically at par to T2, while the minimum yield was recorded under T1 (40.0 kg/ Vine). The total yield was directly proportional to the amount of A grade fruits under each treatment. Amount of A grade fruits was maximum and statistically *at par* under T4 (24.5 kh/ Vine) and T2 (24.0 kg/ Vine). Maximum amount of C grade fruit was recorded under T1 (21.0 kg/ Vine). It was also observed that differences between total yield were comparatively less as compared to the amount of A grade fruits among control and other treatments. The increased yield in kiwifruit, in the present investigation, may be due to larger fruit size and weight induced by growth regulating practices. These results clearly indicate that growth regulating interventions are necessarily required for getting the considerable amount of A grade fruits. Pinching of 20 percent growth at petal fall that continued till harvest at one month interval (T2) marked clear difference for getting A grade fruits. Further addition of dipping the fruits in 50 ppm 2,4 D had non significant increase in getting the A grade fruits. Pinching in itself is a growth regulating technique that suppressed the translocation of photosynthates towards vegetative growth and thus fruit growth was promoted. Pramanick *et al (*2015) also observed the benevolent effect of pinching in providing the maximum amount of A grade fruits in kiwifruit. 2, 4 -D acts as growth retardant and further supported the photosynthates translocation towards the developing fruits. However, non-incremental effect of GA3 was observed. These results were in confirmatory to the findings of Famiani *et al* (2007).

The data pertaining to chemical quality attributes (Table 1) depicted that these attributes were also influenced significantly among various treatment. TSS and TSS: Acid remained high and acidity remained low among all the growth regulating treatments as compared to the control. A high TSS: Acid is always preferred by the consumers and fetches high price. Thus, the growth regulating treatments especially pinching of 20 percent growth at petal fall that continued till harvest at one month interval not only imparted the higher amount of A grade fruits, the chemical quality attributes that are responsible for taste were also affected positively. Similar results of pinching and exogenous application of growth

Table 1 Effect of shoot pruning and growth regulators on yield, fruit grade and chemical attributes.

Treatment	Total Yield (kg/ Vine)	A Grade Fruits (kg/ Vine)	B Grade Fruits (kg/ Vine)	C Grade Fruits (kg/ Vine)	TSS (°Brix)	Acidity (%)	TSS: Acid
T1	40.0 ^{a*}	6.0 ^{a*}	13.0 ^{a*}	21.0 ^{c*}	14.95 ^{a*}	0.85 ^{b*}	17.59 ^{a*}
T2	48.0 ^{c}	24.0 ^{bc}	17.0 ^{c}	7.0 ^{b}	16.10 ^{bc}	0.81 ^{a}	19.88 ^{b}
T3	45.0 ^{b}	23.0 ^{b}	16.0 ^{b}	6.0 ^{a}	16.00 ^{b}	0.82 ^{a}	19.51 ^{b}
T4	48.5 ^{c}	24.5 ^{c}	17.5 ^{c}	6.5 ^{ab}	16.25 ^{c}	0.80 ^{a}	20.31 ^{b}
CD	0.89	1.32	0.80	0.75	0.17	0.02	1.58

*Values within columns having common letter are statistically *at par*.

Sorting and grading of the produce

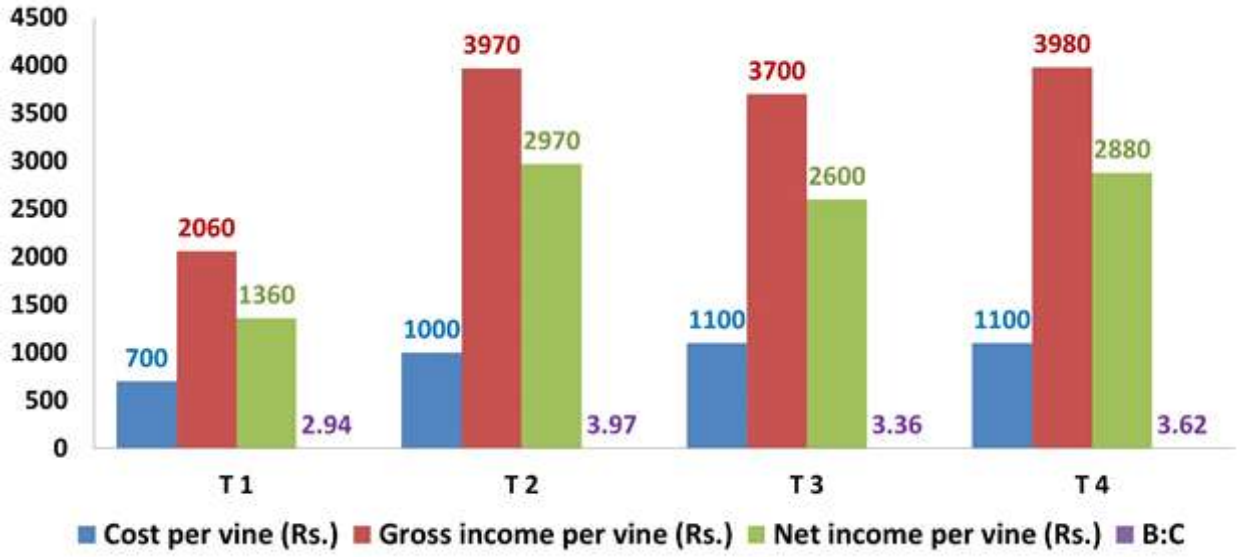

Fig. 1. Economic analysis of the effect of shoot pruning and growth regulators in kiwifruit

regulators on TSS, acidity and TSS: Acid were obtained by **Rana *et al* (2011), Guollo *et al* (2013)** and **Pramanick *et al*(2015)** in kiwifruit.

Economic analysis of this study displayed by Fig. 1 showed that relative amount of A, B and C grade fruits considerable affected the gross return, while varying expenditure on cost of cultivation due to pinching practices and PGR application resulted in different net return and B:C for different treatments. The maximum gross return was calculated for T4 (Rs. 3980 per vine), while the maximum net return (Rs. 2970 per vine) and B:C (3.97) was found for T2. The cost of cultivation was the lowest for T1 (Rs.700 per vine), but its returns were also remained minimum. Such type of economic difference due to variation in A, B and C grade fruits induced by growth regulators was also noticed by Thakur *et al* (2020).

CONCLUSION

The present study clearly established that production of higher amount of A grade fruits is necessary for good marketability and profitability of kiwifruit. Pinching of 20 percent growth at petal fall that continued till harvest at one month interval was found most appropriate for producing A grade fruits and profitability. It was also

observed that preparation and application of PGR formulations are cumbersome operations and difficult to adopt and economically not superior than pinching.

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