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Effect of plant growth regulator on growth, yield and quality of ridge gourd (*Luffa acutangula* L.)

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Abstract
The present investigation was carried out with title "Effect of Plant Growth Regulator on Growth, Yield and Quality of Ridge Gourd (*Luffa acutangula* L.)." at Research Farm, Department of Horticulture, Naini Agricultural Institute, SHUATS, Naini, Prayagraj, Uttar Pradesh during the *Zaid*-2023 with a view to identify the effects of different combinations of GA_3 and its role in growth, yield and quality of Ridge gourd. The experiment was laid in Randomized block design with 10 treatments and 3 replications. Under this experiment, overall, 10 treatment was taken T_1 (V_1 (TMRG 1509) + Water spray), T_2 (V_1 (TMRG 1509) + 60 ppm GA_3), T_3 (V_1 (TMRG 1509) + 80 ppm GA_3), T_4 (V_1 (TMRG 1509) + 100 ppm GA_3), T_5 (V_1 (TMRG 1509) + 120 ppm GA_3), T_6 (V_2 (Aneeta) + Water spray), T_7 (V_2 (Aneeta) + 60 ppm GA_3), T_8 (V_2 (Aneeta) + 80 ppm GA_3), T_9 (V_2 (Aneeta) + 100 ppm GA_3) and T_{10} (V_2 (Aneeta) + 120 ppm GA_3). From the above experimental finding it may be concluded that the treatment T_3 (V_1-TMRG 1509 + 80 ppm GA_3) was found to be best in the terms of growth, yield and quality of Ridge gourd. The highest net return was found in the T_3 (V_1-TMRG 1509 + 80 ppm GA_3) with (Rs 4,21,402/ha) and the highest B:C ratio was found in the same with 3.99.

Keywords: Ridge gourd, plant growth regulators, ga_3, benefit cost ratio

Introduction
Throughout history, fruits and vegetables have been highly regarded for their nutritional value, particularly for their abundance of essential vitamins such as A and C, minerals including electrolytes, and more recently recognized phytochemicals, notably antioxidants. In 2020, India emerged as the world's second-largest producer of fruits and vegetables, with a staggering output of 82.85 million tons of fruits and 166.18 million tons of vegetables, contributing nearly 14.0% to global vegetable production. Despite this impressive production, significant amounts, approximately 25%, go to waste annually, highlighting the challenge of agricultural waste management (Anonymous, 2015) [2].

Agricultural waste, stemming from plant production, is substantial, with India generating significant residues yearly. The country ranks second globally in vegetable production, occupying roughly 3% of India's total cultivated area and contributing about 15% to the global vegetable output. Fruits and vegetables play a crucial role in daily nutrition, offering vital nutrients like vitamins, sugars, minerals, and fibres. Regular consumption of these foods, rich in antioxidants like beta-carotene and ascorbic acid, along with calcium and fibre, can mitigate the risk of various ailments including cancer, heart disease, premature aging, stress, and fatigue. In India, a considerable portion of fruits and vegetables is processed into items such as pickles, juices, jams, and snacks, though some are still consumed raw. Given their perishable nature, prompt processing is essential to prevent post-harvest losses. The connection between nutrition and well-being isn't novel; it dates back to Hippocrates, who advocated for the healing properties of food, stating, "Let food be thy medicine, and medicine be thy food (Jain and Khurdiya, 2002) [9]."Earlier studies have theorized that phytochemicals present in fruits and vegetables may mitigate disease risks by combating oxidative stress induced by free radicals. Brinjal, for instance, is renowned in Ayurveda for its medicinal properties and is particularly beneficial for diabetic patients and those with liver ailments, as suggested by previous research.

The plants in this family are grown around the tropics and in temperate areas, where those with edible fruits were among the earliest cultivated plants in both the Old and New Worlds.

The family *Cucurbitaceae* ranks among the highest of plant families for number and percentage of species used as human food. Cucurbits are the largest group of summer vegetables crops belonging to the family *Cucurbitaceae*. Most of the cucurbits are monoecious in nature except coccinea and pointed gourd (Parval) which are dioicous. Several hermaphrodite and andro-monoecious cultivars are also available in some crops (melons). Fruit is Pepo botanically. *Luffa* is a genus of tropical and subtropical vines in the cucumber family (*Cucurbitaceae*). In everyday non-technical usage, the *Luffa*, usually refers to the fruits of the species *Luffa aegyptiaca*, *Luffa cylindrica* (Roem.) and *Luffa acutangula* (Roxb.). It is cultivated and eaten as a vegetable but must be harvested at a young stage of development to be edible. The vegetable is popular in India, China and Vietnam. When the fruit is fully ripened, it is very fibrous. The fully developed fruit is the source of the scrubbing sponge which is used in bathrooms and kitchens. Ridge Gourd is a creeping vine plant that bears usually cylindrical fruits, which are used as vegetables. Ridge gourd is a cross pollinated diploid crop which is grown in all the parts of India. Gelatinous compound in ridge gourd is 'Luffein'. Most favourable temperature for Ridge gourd is 18 °C-28 °C. Flower colour is pale yellow and anthesis time is morning hours. Botanically, Ridge gourd is known as *Luffa acutangula* Roxb. belongs to family *Cucurbitaceae.* It is a diploid cross-pollinated species with chromosome number 2n=2x=26 (Mckay, 1930) [13]. Ridge gourd probably originated from India and Tropical Asia region of origin. It is mainly cultivated in China, India, Turkey, Iran, and other parts of south-east Asia. Progenitor of Ridge gourd is "*Luffa graveolens".*

The area under Ridge gourd production in India accounts to 10.03 thousand ha with production of 3.16 million tonnes in year 2018-19. (*Source: NHB,* Ministry of Agriculture & Farmers Welfare, Government of India, 2019-20). Bihar ranks first in area and production of Ridge gourd in year 2018-19 followed by Uttar Pradesh and Haryana. The production of Ridge gourd in Uttar Pradesh is 427.81 tonnes for year 2018-19. The ridge gourd is used as cooked vegetable. It has many uses in ayurvedic medicines. According to 'Ayurvedic' medicines, the oil from its seed is good for the liver and the body. Ridge gourd has moisture 95.2 g, magnesium 11 mg, sodium 2.9 mg, Vitamin C 5 mg, 3.5g Carbohydrates, Oxalic acid 27 mg, Calcium 40 mg, Phosphorous 40 mg, Potassium 50 mg, Chlorine 7 mg and many other nutrients out of 100 g of edible portion. (Nutritional Research Laboratory, Coonoor, Choudhary, 2013). Ridge gourd is well adapted crop for warm season crop, and it does not withstand even light frost. The crop performs well in temperature range between 18°C- 28°C and soil having pH ranging between 6.0-7.0irrespective of its kind from sandy to heavy clay soil. It is grown as sole crop in India in *Kharif* and *Kharif* season. It is well suited to hot and warm climate with annual rainfall of 65-85 cm.Plant growth regulators (PGRs) are chemicals that modify plant growth, affecting branching, shoot growth, return bloom, fruit removal, and maturity. PGR performance is influenced by plant absorption, dose, timing, cultivar, and weather conditions. PGRs can be categorized into five classes: auxins, gibberellins, and gibberellin biosynthesis inhibitors, cytokinin, abscisic acid, and ethylene modifiers. There are also products that block hormone biosynthesis, such as Apogee and Retain. Plant growth regulators are the chemical substances, when applied in small amounts modify the plant growth usually by stimulating part of the natural growth regulatory system. Growth regulators are known to have an effect on the production of earliest flower, yield ratio of male/ female flower, number of fruits and weight of fruit. Initiation of flower bud, development of flowers and fruits are controlled by physiological process. In many agricultural plants, these processes can often be used to alter by proper application of plant growth substances (Jeevitha and Vasudevan, 2019) [11]. Gibberellins (GA) promote cell elongation and shoot growth and are involved in regulating dormancy. Prolamin®/Perlan® and Pro Gibb 40SB/Falgro containing GA_3 and GA_4+7 have been used to improve fruit size and reduce russeting in apples, delay ripening and improve fruit firmness in sweet cherries, and manage flowering in tart cherries. Gibberellic acid (GA) and cytokinin can stimulate flowering and increase fruit set in chilli plants. They can help in synchronizing flowering, resulting in uniform fruit production and higher yields (Arora and Bist, 2016) [3].

Materials and Methods

During the *Zaid* seasons of 2023 the research was carried out at the Horticultural Research Farm, which is part of the Department of Horticulture at the Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. The university is located about five kilometres from Prayagraj City, next to the Prayagraj–Rewa National Highway. The Department of Horticulture at the Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P., India, provided all necessary resources for successful crop cultivation, including labour, inputs, irrigation supplies, and field preparation.

Location and climatic conditions of the experimental farm

Prayagraj lies within the central plain sub-zone of Agro-climatic zone V, as per the Perspective and Strategic Plan (SPSP) for IWMP of Uttar Pradesh by the Department of Land Development and Water Resources, Government of U.P. The geographical coordinates for Naini range between 20° 33' 40'' to 21' 50" N latitude and 73° 27' 58'' to 73° 56' 36'' E longitude. The region features a tropical climate characterized by relatively hot summers, moderately cold winters, and humid, warm monsoons. Rainfall is abundant, primarily occurring from June to September, predominantly driven by the south-west advancing monsoon. The bulk of precipitation concentrates in July and August.

Growth Parameters

Days to Germinate

The number of days taken from sowing to days to first appearance of seedlings in experimental plots was observed as days to germinate. The data were recorded, averaged, and analysed for all replications.

Survival percentage

Survival percentage was calculated for each replication. It was calculated by using formula given below:

$$\text{Survival percentage (\%)} = \frac{No.of\ seedlings\ survived\ and\ grew}{Total\ No\ of\ seedlings\ emerged\ after\ germination} \text{ X } 100$$

Vine length (cm) [20, 40, 60 DAS]
The height of five randomly selected grafted plants from each plot was measured in cm with help of a meter scale from ground level to tip of the shoot at 20, 40, 60 DAS. The average of vine length of each replication was recorded and subjected to statistical analysis.

B. Earliness Parameters
Appearance of male flower in 50% plants
The number of days taken from sowing to days to 50% appearance of male flower in experimental plots was observed as days to 50% male flowering or Appearance of male flowers in 50% plants. The data were recorded, averaged, and analysed for all replications.

Appearance of first pistillate flowers in 50% plants
The number of days taken from sowing to days to 50% appearance of female flower in experimental plots was observed as days to 50% female flowering or Appearance of first pistillate flowers in 50% plants. The data were recorded, averaged, and analysed for all replications.

Days to first harvest
The number of days taken from sowing to days to first picking of fruits post maturity in experimental plots was observed as days to first harvest. The data were recorded, averaged, and analysed for all replications.

Quality parameters
Total Soluble Solids or TSS (°Brix)
The percentage of total soluble solids of the fruit was determined with the help of Portable Hand Refractometer. The sample of juice for this purpose was taken from the strained juice. The observed value of T.S.S. was recorded from the scale of the instrument (0-32 range).

Results and Discussion
Days to germinate
The results pertaining to the effect of plant growth regulators on days to germinate of Ridge gourd are presented in Table 1.
It was evident from analysis that days to germinate in plant was influenced by application of gibberellic acid in ridge gourd varieties sown. There was significant difference present among the levels of gibberellic acid applied. It was found that T_8 (V_2-Aneeta + 80 ppm GA_3) had taken minimum days to germinate (10.07 days) which was followed by T_2 (V_1-TMRG 1509 + 60 ppm GA_3) having 10.60 days whereas the maximum days taken to germinate (12.40 days) was observed in T_5 (V_1-TMRG 1509 + 80 ppm GA_3).
In ridge gourd variety Aneeta, the application of 80 ppm gibberellic acid expedites germination due to its optimal hormonal concentration. Gibberellic acid plays a crucial role in seed germination by breaking dormancy and promoting cell elongation. At 80 ppm, it activates the necessary metabolic processes without inducing stress or inhibiting growth, ensuring prompt germination. Lower doses may not provide sufficient hormonal stimulation, leading to delayed or inconsistent germination, while higher doses could potentially overwhelm the seed's sensitivity to gibberellic acid, resulting in adverse effects such as abnormal growth or germination inhibition. Thus, 80 ppm strikes a balance, maximizing germination efficiency in ridge gourd variety Aneeta. Similar findings were reported by Saha *et al.*, (2019) [11]; Khan *et al.*, (2021) [19]; Nishant *et al.*, (2021) [20] in Tomato.

Table 1: Effect of gibberellic acid on the days to germinate applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	Days to germinate
T_1	V_1 (TMRG 1509) + Water spray	11.87
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	10.60
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	11.93
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	12.33
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	12.40
T_6	V_2 (Aneeta) + Water spray	12.27
T_7	V_2 (Aneeta) + 60 ppm GA_3	11.47
T_8	V_2 (Aneeta) + 80 ppm GA_3	10.07
T_9	V_2 (Aneeta) + 100 ppm GA_3	10.73
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	10.93
'F' Test		S
SE. m (±)		0.50
CD. at 5%		1.46
CV.		8.27

2 Survival percentage
Analysis clearly showed that the application of gibberellic acid to sown ridge gourd varieties affected the plant's survival percentage. There was a noticeable variation in the amounts of gibberellic acid used. It was found that T_8 (V_2-Aneeta + 80 ppm GA_3) had maximum survival percentage (100.00%) which was followed by T_6 (V_2-Aneeta + Water Spray) having 98.09% whereas the minimum survival percentage (94.96%) was observed in T_{10} (V_2-Aneeta + 100 ppm GA_3).
In ridge gourd variety Aneeta, applying 80 ppm gibberellic acid ensures maximum survival percentage due to its finely tuned hormonal concentration. Gibberellic acid at this level triggers optimal physiological responses without causing stress or excessive growth stimulation. This concentration effectively breaks seed dormancy, promoting uniform germination and subsequent seedling establishment. Lower doses may not sufficiently activate metabolic processes, leading to reduced survival rates and uneven growth. Conversely, higher doses risk overstimulation, potentially inducing stress and impairing seedling vigour. Therefore, the precise balance achieved with 80 ppm gibberellic acid enhances the resilience and vitality of ridge gourd variety Aneeta, resulting in superior survival percentages compared to other doses. Similar findings were reported by Saha *et al.*, (2019) [11]; Khan *et al.*, (2021) [19]; Nishant *et al.*, (2021) [20] in Tomato.

Table 2: Effect of gibberellic acid on the survival percentage applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	Survival percentage (%)
T_1	V_1 (TMRG 1509) + Water spray	96.18
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	96.74
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	96.74
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	97.37
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	96.08
T_6	V_2 (Aneeta) + Water spray	98.09
T_7	V_2 (Aneeta) + 60 ppm GA_3	95.41
T_8	V_2 (Aneeta) + 80 ppm GA_3	100.00
T_9	V_2 (Aneeta) + 100 ppm GA_3	95.83
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	94.96
'F' Test		S
SE. m (±)		3.56
CD. at 5%		10.44
CV.		6.98

Vine length

It was evident from analysis that vine length in plant was influenced by application of gibberellic acid in ridge gourd varieties sown. There was significant difference present among the levels of gibberellic acid applied. It was found that T_3 (V_1-TMRG 1509 + 80 ppm GA_3) had longest vine length (12.43 cm) which was followed by T_2 (V_1-TMRG 1509 + 60 ppm GA_3) having 11.96 cm whereas the shortest vine (9.31 cm) was observed in T_1 (V_1-TMRG 1509 + Water spray) recorded at 20 days after sowing (DAS).T_3 (V_1-TMRG 1509 + 80 ppm GA_3) had longest vine length (95.22 cm) which was followed by T_8 (V_2-Aneeta + 80 ppm GA_3) having 91.32 cm whereas the shortest vine (75.35 cm) was observed in T_6 (V_2-Aneeta + Water spray) recorded at 40 days after sowing (DAS).T_3 (V_1-TMRG 1509 + 80 ppm GA_3) had longest vine length (199.14 cm) which was followed by T_2 (V_1-TMRG 1509 + 60 ppm GA_3) having 196.21 cm whereas the shortest vine (164.05 cm) was observed in T_6 (V_2-Aneeta + Water spray) recorded at 60 days after sowing (DAS). Applying 80 ppm gibberellic acid promotes maximum vine length in the ridge gourd variety TMRG 1509 because of its ideal hormonal concentration. At this stage, gibberellic acid promotes vigorous vine growth by facilitating cell elongation and division without leading to excessive elongation or structural weakness. Higher doses may cause stress or upset the hormonal balance, which could result in abnormal growth patterns. Lower doses may not stimulate the plant's hormones enough, resulting in stunted growth and limited vine length. Compared to other dosages of gibberellic acid, 80 ppm gibberellic acid maximises the growth potential of the ridge gourd variety TMRG 1509 by striking the correct balance, thereby increasing vine elongation and ultimately contributing to increased vine length. Findings were earlier reported by Saha *et al.*, (2019) [11]; Khan *et al.*, (2021) [19]; Nishant *et al.*, (2021) [20] in Tomato.

Table 3: Effect of gibberellic acid on the vine length applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	Vine length (cm)		
		20 DAS	40 DAS	60 DAS
T_1	V_1 (TMRG 1509) + Water spray	9.31	79.67	176.05
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	11.96	87.79	196.21
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	12.43	95.22	199.14
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	10.60	90.40	191.18
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	9.84	81.48	180.52
T_6	V_2 (Aneeta) + Water spray	9.75	75.35	164.05
T_7	V_2 (Aneeta) + 60 ppm GA_3	10.99	81.57	179.81
T_8	V_2 (Aneeta) + 80 ppm GA_3	11.69	91.32	189.23
T_9	V_2 (Aneeta) + 100 ppm GA_3	11.03	81.95	173.26
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	10.86	84.83	177.17
'F' Test		S	S	S
SE. m (±)		0.69	3.44	5.98
CD. at 5%		2.03	10.08	17.54
CV.		12.09	7.68	6.22

B) Phenological parameters

4.4 Appearance of male flower in 50% plants

Analysis showed that the application of gibberellic acid to sown ridge gourd varieties affected the appearance of the male flower in 50% of the plants. There was a noticeable variation in the amounts of gibberellic acid used. T_7 (V_2-Aneeta + 60 ppm GA_3) had taken minimum days to appearance of male flower in 50% plants (47.80 days) which was followed by T_4 (V_1-TMRG 1509 + 100 ppm GA_3) having 48.73 days whereas the maximum days to appearance of male flower in 50% plants (53.67 days) was observed in T_1 (V_1-TMRG 1509 + Water spray).

In ridge gourd variety Aneeta, applying 60 ppm gibberellic acid leads to the minimum days required for the appearance of male flowers in 50 percent of the plants due to its balanced hormonal concentration. Gibberellic acid at this level effectively accelerates flowering initiation without inducing stress or disrupting plant development. Lower doses may not provide sufficient hormonal stimulation, delaying flower development and extending the time to reach the 50 percent threshold. Conversely, higher doses

risk overstimulation, potentially causing hormonal imbalances and irregular flowering patterns. By maintaining an optimal hormonal balance, 60 ppm gibberellic acid promotes timely flower initiation in ridge gourd variety Aneeta, ensuring the rapid appearance of male flowers in a significant proportion of plants compared to other doses of gibberellic acid. Similar findings were reported by Saha *et al.,* (2019) [11]; Khan *et al.,* (2021) [19]; Nishant *et al.,* (2021) [20] in Tomato.

Table 4: Effect of gibberellic acid on the Appearance of male flower in 50% plants applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	Appearance of male flower in 50% plants
T_1	V_1 (TMRG 1509) + Water spray	53.67
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	53.33
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	51.20
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	48.73
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	52.73
T_6	V_2 (Aneeta) + Water spray	50.20
T_7	V_2 (Aneeta) + 60 ppm GA_3	47.80
T_8	V_2 (Aneeta) + 80 ppm GA_3	50.20
T_9	V_2 (Aneeta) + 100 ppm GA_3	52.07
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	52.67
'F' Test		S
SE. m (±)		1.14
CD. at 5%		3.34
CV.		4.22

Appearance of first pistillate flowers in plants

Analysis showed that the application of gibberellic acid to sown ridge gourd varieties affected the appearance of first pistillate flowers of the plants. There was a noticeable variation in the amounts of gibberellic acid used. T_8 (V_2-Aneeta + 80 ppm GA_3) had taken minimum days to appearance of first pistillate flowers in plants (57.47 days) which was followed by T_7 (V_2-Aneeta + 60 ppm GA_3) having 57.80 days whereas the maximum days to appearance of first pistillate flowers in plants (61.13 days) was observed in T_1 (V_1-TMRG 1509 + Water spray).

Because of its exact hormonal concentration, applying 80 ppm gibberellic acid to the ridge gourd variety Aneeta reduces the number of days needed for the first pistillate flowers to appear. This level of gibberellic acid effectively stimulates the initiation and development of flowers without causing stress or hormonal imbalance. Lower dosages might not provide enough hormone stimulation, which would cause flower formation to be delayed and the appearance of the first pistillate flowers to take longer to manifest. Higher doses, on the other hand, run the risk of overstimulating, which could interfere with floral development and postpone flower emergence. Compared to other dosages of gibberellic acid, 80 ppm gibberellic acid guarantees early and uniform pistillate flower formation in the ridge gourd variety Aneeta, promoting early fruit set and crop yield. This is achieved by preserving the ideal hormonal balance. Findings were in accordance with earlier findings of Saha *et al.,* (2019) [11]; Khan *et al.,* (2021) [19]; Nishant *et al.,* (2021) [20] in Tomato.

Table 5: Effect of gibberellic acid on the Appearance of first pistillate flowers in plants applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	Appearance of first pistillate flowers in plants
T_1	V_1 (TMRG 1509) + Water spray	61.13
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	60.60
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	58.40
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	58.13
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	59.87
T_6	V_2 (Aneeta) + Water spray	59.60
T_7	V_2 (Aneeta) + 60 ppm GA_3	57.80
T_8	V_2 (Aneeta) + 80 ppm GA_3	57.47
T_9	V_2 (Aneeta) + 100 ppm GA_3	59.73
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	60.07
'F' Test		S
SE. m (±)		1.22
CD. at 5%		3.58
CV.		3.91

Days to first harvest

Analysis showed that the application of gibberellic acid to sown ridge gourd varieties affected the days to first harvest. There was a noticeable variation in the amounts of gibberellic acid used. T_8 (V_2-Aneeta + 80 ppm GA_3) had taken minimum days to first harvest (77.53 days) at par with T_7 (V_2-Aneeta + 60 ppm GA_3) having 77.53 days whereas the maximum days to first harvest (81.47 days) was observed in T_1 (V_1-TMRG 1509 + Water spray).

Applying 80 ppm gibberellic acid to the ridge gourd variety Aneeta reduces the number of days needed for the first harvest because of its ideal hormonal concentration. At this concentration, gibberellic acid efficiently speeds up plant growth and development without causing stress or lowering fruit quality. Lower dosages might not stimulate hormones enough to cause slower growth rates and later fruit maturation, which would prolong the time until the first harvest. Higher doses, on the other hand, run the risk of overstimulating, which could result in abnormal growth patterns or early fruit drop. In contrast to other gibberellic acid dosages, 80 ppm gibberellic acid encourages strong plant growth, early flower formation, and timely fruit development in the ridge gourd variety Aneeta. This eventually results in the earliest first harvest. Findings were in accordance with earlier findings of Saha *et al.,* (2019) [11]; Khan *et al.,* (2021) [19]; Nishant *et al.,* (2021) [20] in Tomato.

Table 6: Effect of gibberellic acid on the days to first harvest applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	Days to first harvest
T_1	V_1 (TMRG 1509) + Water spray	81.47
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	80.93
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	78.73
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	78.47
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	80.20
T_6	V_2 (Aneeta) + Water spray	79.67
T_7	V_2 (Aneeta) + 60 ppm GA_3	77.53
T_8	V_2 (Aneeta) + 80 ppm GA_3	77.53
T_9	V_2 (Aneeta) + 100 ppm GA_3	79.80
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	80.13
'F' Test		S
SE. m (±)		1.18
CD. at 5%		3.45
CV.		2.82

Quality parameter

TSS

Table 7.present the findings regarding the impact of plant growth regulators on the TSS produced by a single Ridge gourd plant. According to analysis, the TSS produced by each ridge gourd variety on the plants was impacted by the application of gibberellic acid. There was a noticeable variation in the amounts of gibberellic acid used. T_8 (V_2-Aneeta + 80 ppm GA_3) had maximum TSS (3.73 °Brix) followed by T_{10} (V_2-Aneeta + 120 ppm GA_3) having 3.73 °Brix whereas the minimum TSS (2.73 °Brix) was observed in T_6 (V_2-Aneeta + Water spray).

The precise application of 60 ppm gibberellic acid (GA_3) emerges as the determining factor in achieving superior Total Soluble Solids (TSS) in TMRG 1509 ridge gourd variety. This concentration has been meticulously calibrated to ensure optimal hormonal regulation within the plants, thereby facilitating enhanced sugar accumulation and sweetness in the fruits. In contrast, lower concentrations may not provide sufficient hormonal stimulation to promote robust sugar synthesis, while higher concentrations might lead to imbalances or irregularities in sugar content. Consequently, fruits from plants treated with 60 ppm GA_3 consistently exhibit better TSS compared to those subjected to other GA_3 levels, underscoring the pivotal role of precise hormonal modulation in optimizing fruit quality in ridge gourd cultivation. Findings were in accordance with earlier findings of Saha *et al.,* (2019) [11]; Khan *et al.,* (2021) [19]; Nishant *et al.,* (2021) [20] in Tomato.

Table 7: Effect of gibberellic acid on the TSS applied on different varieties of Ridge gourd.

Treatment Notation	Treatment details	TSS (°Brix)
T_1	V_1 (TMRG 1509) + Water spray	2.87
T_2	V_1 (TMRG 1509) + 60 ppm GA_3	3.33
T_3	V_1 (TMRG 1509) + 80 ppm GA_3	3.70
T_4	V_1 (TMRG 1509) + 100 ppm GA_3	3.60
T_5	V_1 (TMRG 1509) + 120 ppm GA_3	3.33
T_6	V_2 (Aneeta) + Water spray	2.73
T_7	V_2 (Aneeta) + 60 ppm GA_3	3.57
T_8	V_2 (Aneeta) + 80 ppm GA_3	3.77
T_9	V_2 (Aneeta) + 100 ppm GA_3	3.40
T_{10}	V_2 (Aneeta) + 120 ppm GA_3	3.73
'F' Test		S
SE. m (±)		0.21
CD. at 5%		0.62
CV.		11.69

Conclusion

From the above experimental finding it may be concluded that the treatment T_3 (V_1-TMRG 1509 + 80 ppm GA_3) was found to be best in the terms of growth, yield and quality of Ridge gourd. The highest net return was found in the T_3 (V_1-TMRG 1509 + 80 ppm GA_3) with (Rs 4,21,402/ha) and the highest B:C ratio was found in the same with 3.99.

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