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THE EFFECT OF GAMMA IRRADIATION ON ENHANCEMENT OF YIELD COMPONENTS OF DIFFERENT VARIETIES OF SUNFLOWER (*HELIANTHUS ANNUUS* L.).

SIFAT ULLAH KHAN SIKANDRY[1], REHMAN ULLAH KHAN [1], SAAD ULLAH KHAN [1], SIKANDAR KHAN SHERWANI [2], SULTAN MEHMOOD, [1] IHSAN ULLAH, [1] HIDAYAT ULLAH KHAN[1]

1. Department of Botany, University of Science and Technology, Bannu.
2. Department of Microbiology, Federal Urdu University of Arts, Science and Technology

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Abstract: A field experiment to study the genetic variation in M1 Gamma irradiated population of two varieties of sunflower (*Helianthus annuus* L.) was conducted at the green house field area, University of Science & Technology Bannu, during crop season, 2011. The Gamma irradiation has been enhanced nearly all the normal characteristics of the variety Syngenta and variety High sun of sunflower. The control seeds of both these varieties reflected emergence from 7-12 days but emergence were exceeded at 25 krad from 12-17 days in the irradiated seeds of these varieties. The plant heights were also enhanced and all the irradiated plants of both the varieties have achieved above normal height and especially in case of T2 treated Highsun variety. So for as the parameters like, Number of leaves per plant, length and width of leaves are concerned were found positively enhanced. Profound variability was observed in case of days to first flowering, number of sepals and petals in both the varieties of sunflower. Although the parameters like diameter of flower's head along with number of seeds a reasonable enhancement was achieved.

Keywords: Experiment Study, Gama Irradiation

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Corresponding Author:

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INTRODUCTION

Sunflower (Helianthus annuus L) is an annual plant native to the Americas that possess a large inflorescence (flowering head). The sunflower got its name from its huge fiery blooms, whose shape and image is often used to depict the sun. The sunflower has a rough, hairy stem, broad, coarsely toothed, rough leaves and circular heads of flowers. The heads consist of 1,000-2,000 individual flowers joined together by a receptacle base. Sunflower seeds were taken to Europe in the 16th century where, along with sunflower oil, they became a widespread cooking ingredient. Sunflower leaves can be used as a cattle food, while the stems contain a fiber which may be used in paper production. The seeds of Syngenta and High sun varieties of sunflower were irradiated with different doses of gamma irradiation (0Krad, 10Krad, 15Krad, 20Krad and 25Krad) and were sown in experimental field of UST Bannu, Town ship campus by Sifat Ulla Khan Sikandry Guided by Supervisor Dr. M. Subhan,

MATERIAL & METHODS:

Present study will be conducted in the sowing period of 2010-2011 to ascertain the effective levels of gamma radiation on the varieties of sunflower (*Helianthus annus* L.), two varieties: Highsun-33 and Syngenta (NK=10 KR) were used to expose to different doses of radiations and were grown in the research field of University of Science and Technology Bannu, Khyber Pakhtunkhwa Pakistan at dated Feb15, 2011. The seeds were obtained from Tar Nab Form Peshawar. Later on the seeds treated with 0, 10, 15, 20 and 25 Krad doses of gamma radiation in CO60 gamma source working at NIFA (Nuclear Institute of Food and Agriculture at Peshawar). The Data were recorded for these two varieties of sunflower treated by five different doses of gamma rays. The experimental plot size were designed as 60feet in length North to South side and 31.25 feet in width in East to West side. Then three replications of about 20 feet were made and then the seeds were sown at seed to seed distance of about 15.62inc or 187.5 cm.

The data were recorded on the following parameters:

(i) Days to emergence,

(ii) Number of leaves per plant,

(iii) Leaves Length per Plant,

(iv) Leaves Width per Plant,

(v) Petiole Length per Plant leaves,

(vi) Plant height at Maturity (in cm or inch),

(vii) Days to first flowering,

(viii) No of Sepals per plant Inflorescence,

(ix) No of Petals per Plant Inflorescence,

(x) Flower Head Width (Diameter).

Results & Discussion: The result of the present research is presented in Table 1.1

to 1.10. These tables not only show the averages obtained for various characteristics but also show the significant variation which are marked in different lettering. The analysis of variance for respective traits has been shown in Appendix-1 to 10 in the research thesis. The statistical descriptions of the result of this research are as follows:

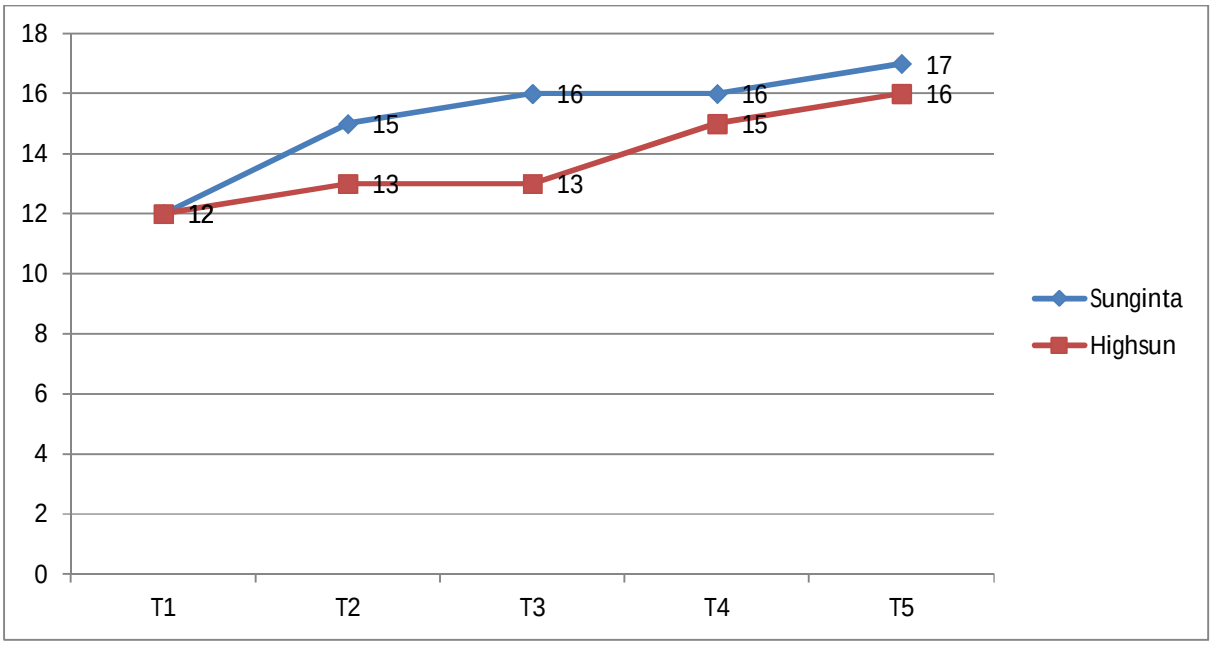
1.1 Days to Seedling Emergence at 50%:

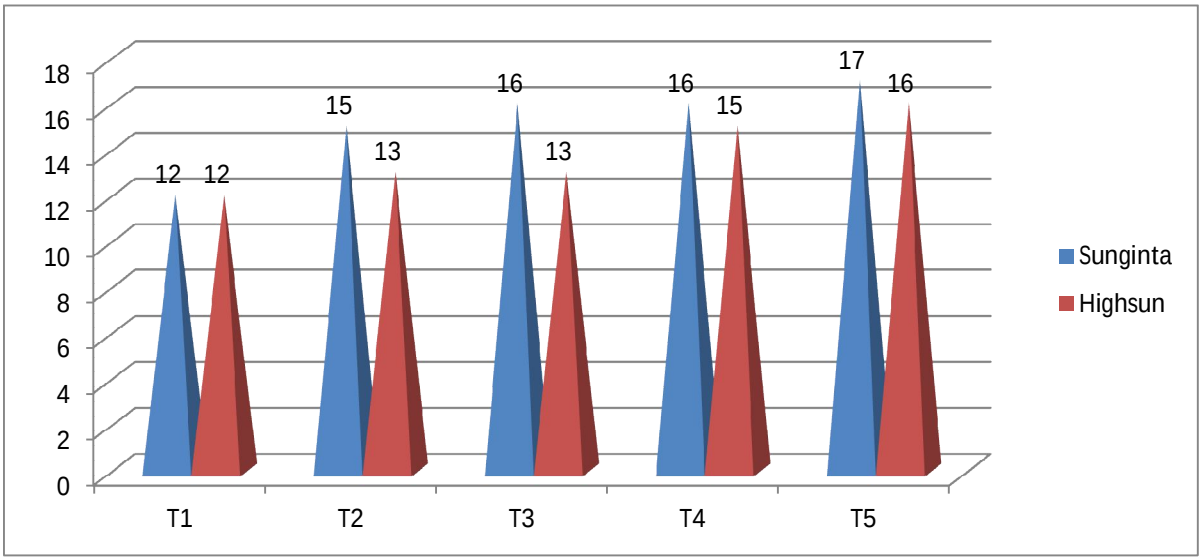
The analysis of variance for seedling emergence has clearly indicates that average, recorded for varieties and gamma radiation doses as well as the interaction were highly significant at 5% level of probability. The seedling emergence percentage was maximum in T5 (25 Krad) 16.50% and was followed by 20 Krad (16%) likewise minimum seedling emergence 12% was noted when radiation doses were gradually decrease to 15 Krad (14.50%) and 10 Krad (14%) respectively. Similarly maximum seedling emergence 15.27% was noted in variety Syngenta whereas variety Highsun showed significantly less seedling emergence 13.94%.

Table 1.1 Effect of Gamma Radiation on Seedling Emergence:

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	12	12	12
T2 (10 KRAD)	15	13	14
T3 (15 KRAD)	16	13	14.50
T4 (20 KRAD)	16	15	16
T5 (25 KRAD)	17	16	16.50
MEAN	15.267 a	13.933 b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



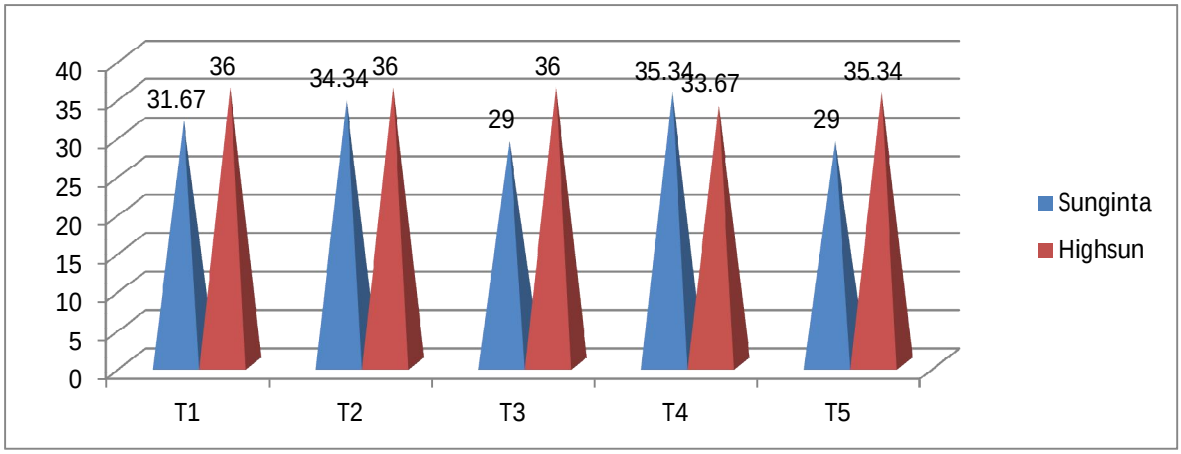


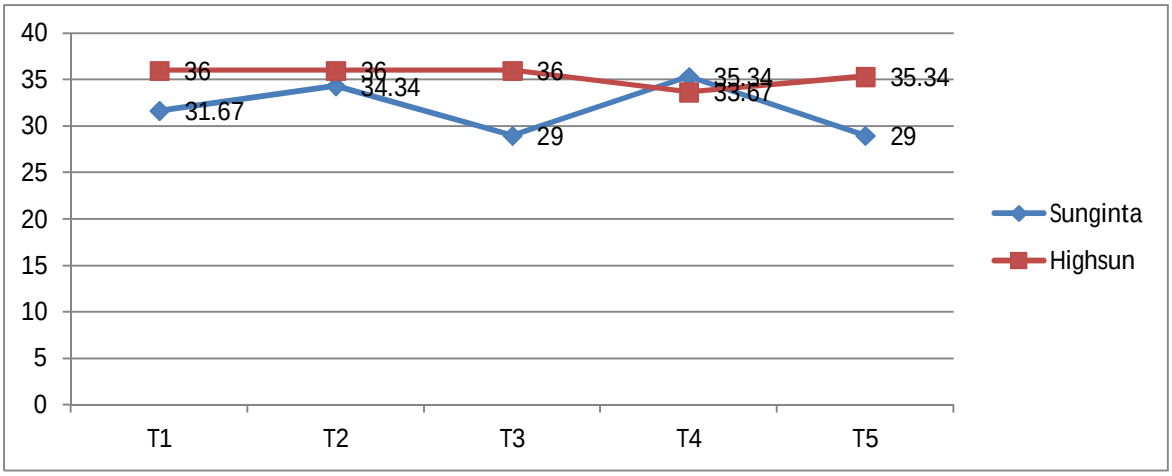
1.2 No of Leaves per Plant: The mean values and analysis of variance for number of leaves per plant depicted that mean value recorded for gamma radiation doses were non-significant but the average values preserved for varieties and interaction were significant at 5% level of probability.

Table 1.2 Effect of Gamma Radiation on No of Leaves per Plant is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	31.67	36	33.84
T2 (10 KRAD)	34.34	36	35.16
T3 (15 KRAD)	29	36	32.50
T4 (20 KRAD)	35.34	33.67	34.50
T5 (25 KRAD)	29	35.34	32.17
MEAN	31.87a	35.40b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



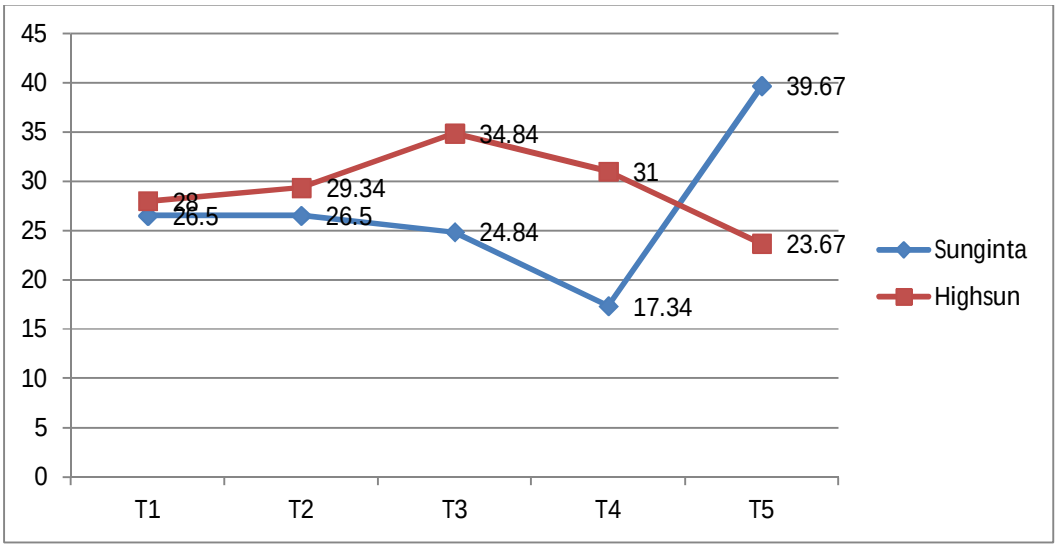


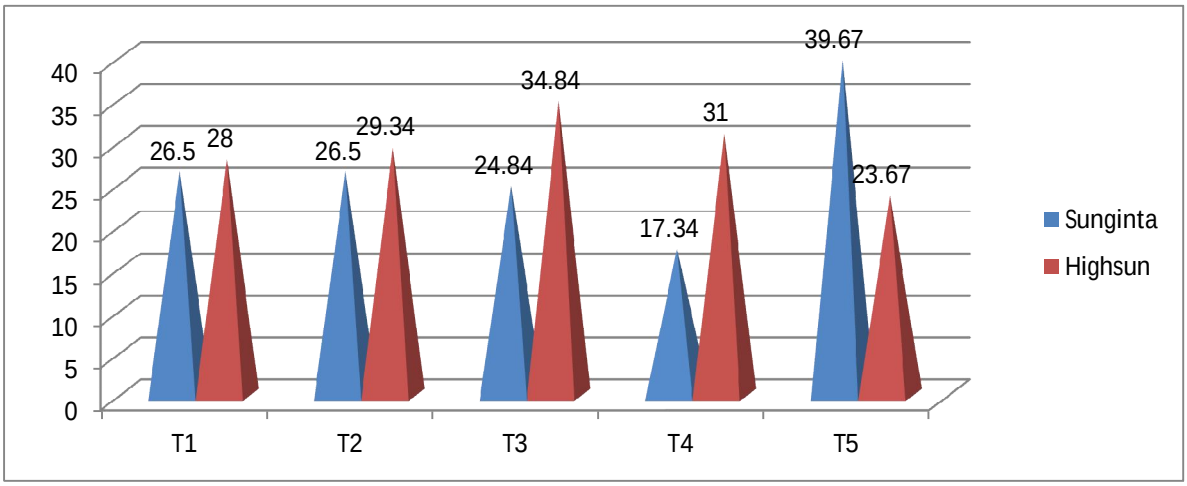
1.3 Leaves Length per Plant: The analysis of variance for leaves length per plant shows highly significant differences in mean values observed for varieties under trails as well as radiation doses. Also the mean values recorded for interaction showed significant differences at 5% level of probability. From the table of mean (1.3) it reveals that maximum length of leaves 31.67cm were recorded, when seed were treated with gamma radiation dose of 25 Krad. When the level of radiation was reduced to 20 Krad, then lesser the length of leaves 24.17cm were taken in both the varieties. When seed were irradiated at 10 Krad and 15 Krad dose then the leaves length were decreased to 24.92cm and 29.84cm respectively.

1.4 Table 1.3 Effect of Gamma Radiation on the Length of Leaves is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	26.50	28	27.25
T2 (10 KRAD)	26.50	29.34	24.92
T3 (15 KRAD)	24.84	34.84	29.84
T4 (20 KRAD)	17.34	31	24.17
T5 (25 KRAD)	39.67	23.67	31.67
MEAN	26.97a	29.37b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



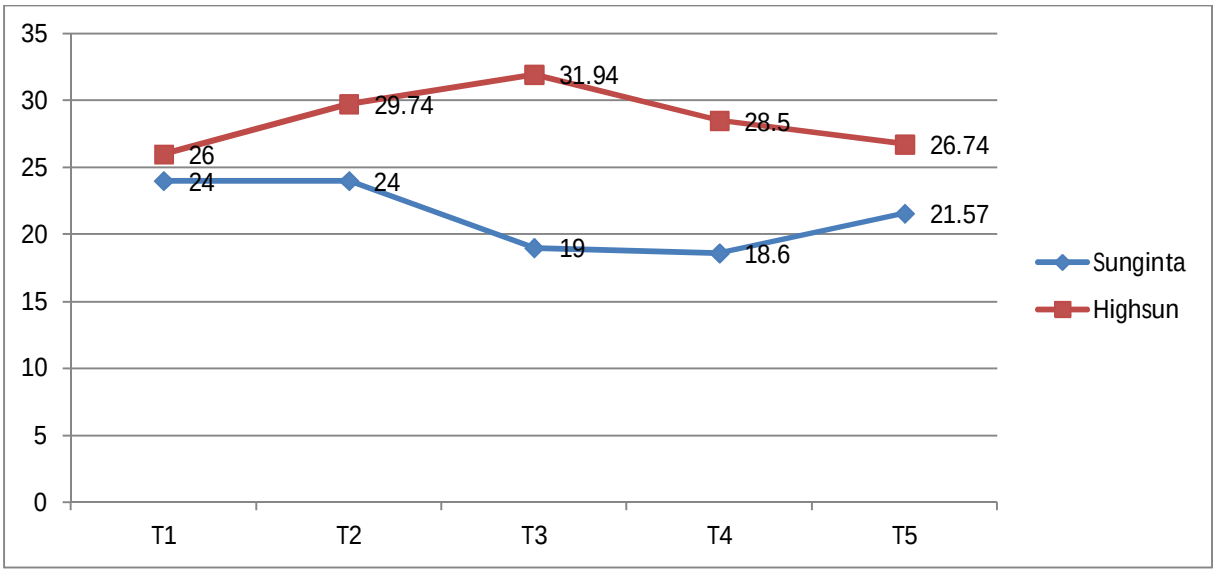


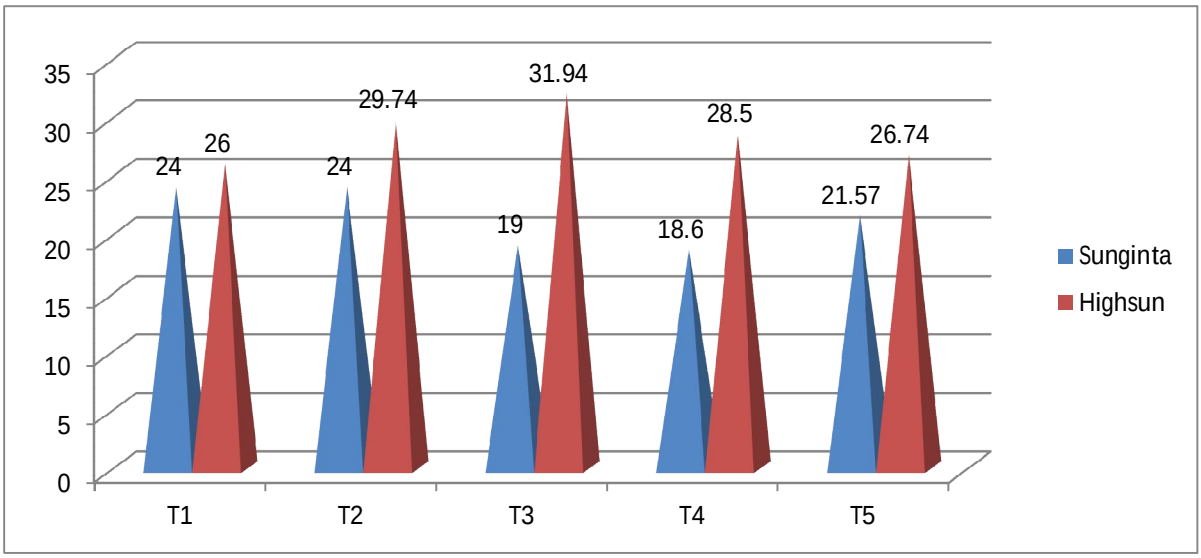
1.5 **Leaves Width per Plant:** The mean values for Leaves width per plant show highly significant differentiation at 5% level of probability for varieties but it also depict that the gamma irradiation doses and interaction between the varieties and doses were non significant. From the mean table it is clear that the largest width of leaves (26.87cm) recorded for gamma radiation dose of 10 Krad and was followed by 15 Krad dose of gamma radiation. The largest width of leaves was 28.58cm as recorded for Highsun variety while that of Syngenta was 21.44cm.

Table 1.4 Effect of Gamma Radiation on Leaves Width is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	24	26	25
T2 (10 KRAD)	24	29.74	26.87
T3 (15 KRAD)	19	31.94	25.47
T4 (20 KRAD)	18.60	28.50	23.55
T5 (25 KRAD)	21.57	26.74	24.15
MEAN	21.44a	28.58b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



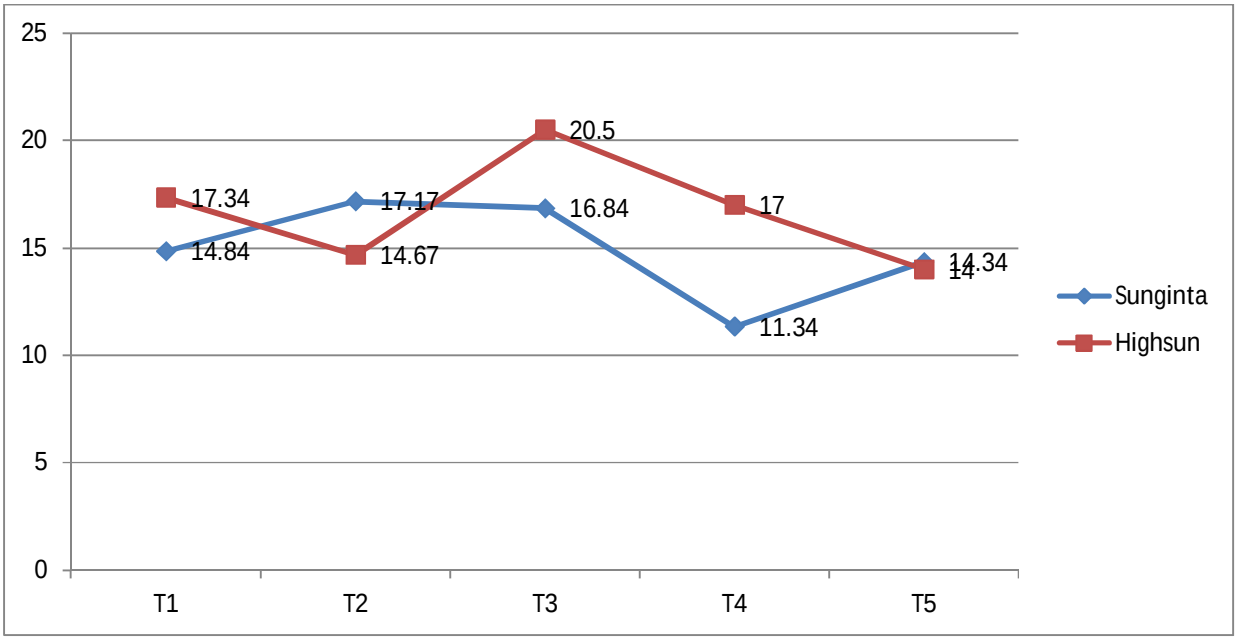


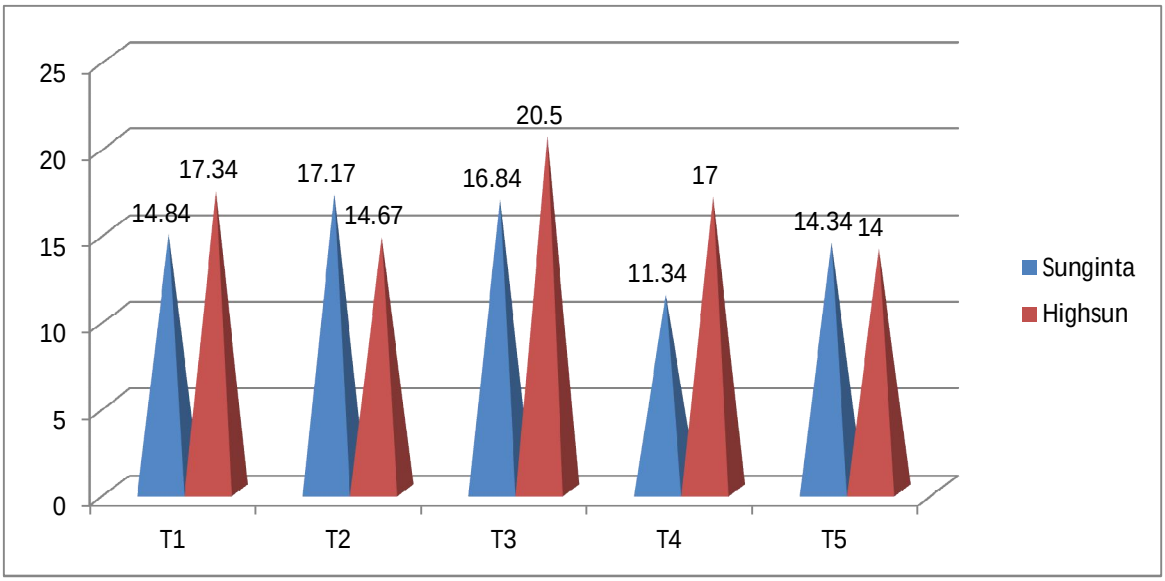
1.5 Petiole Length per Plant: The analysis of variance for petiole length per plant reflected that the gamma irradiation doses and varieties were significant while the interaction between the varieties and doses were non-significant.

Table 1.5 Effect of Gamma Radiation on Petiole Length per Plant is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	14.84	17.34	16.09
T2 (10 KRAD)	17.17	14.67	15.91
T3 (15 KRAD)	16.84	20.50	18.67
T4 (20 KRAD)	11.34	17	14.17
T5 (25 KRAD)	14.34	14	14.17
MEAN	14.90a	16.70b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



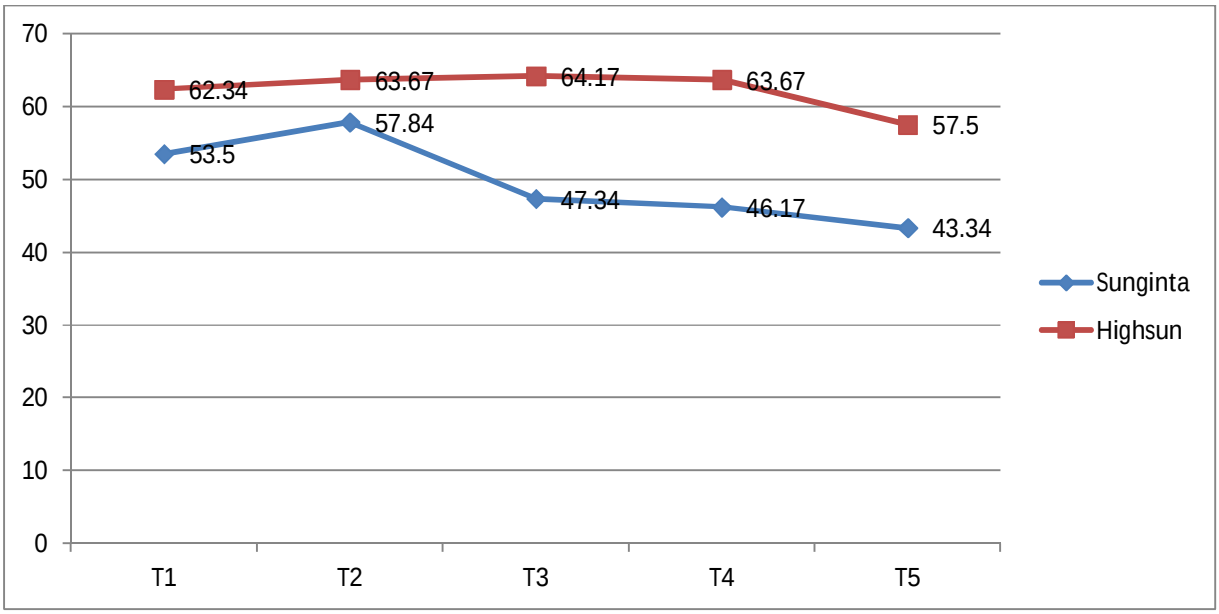


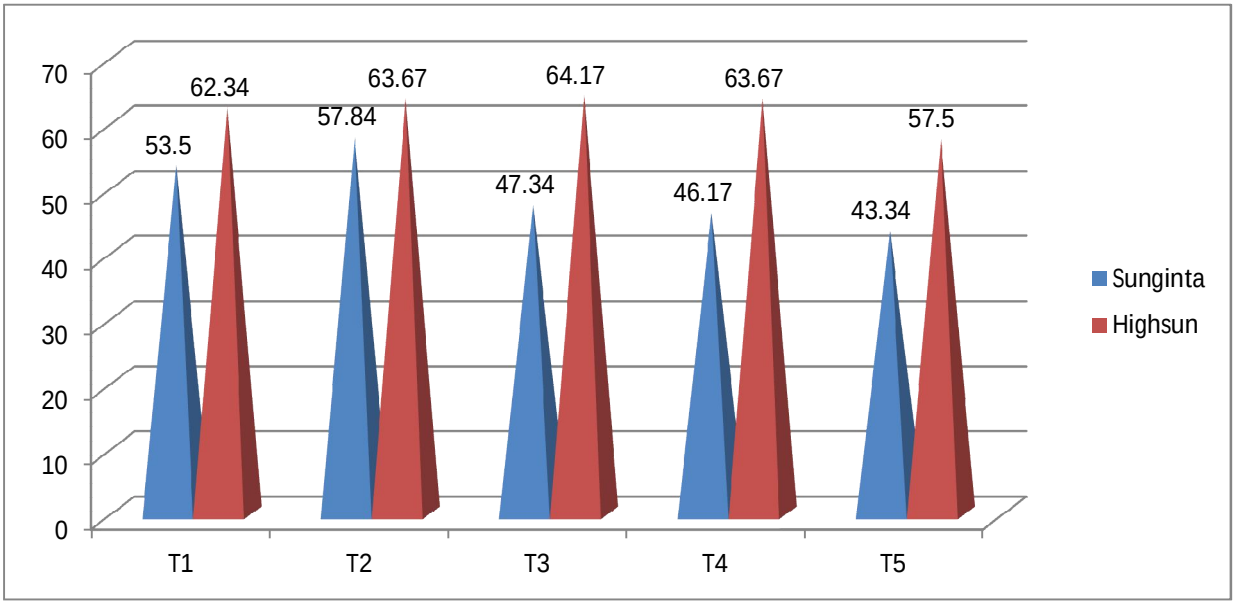
1.6 Stem Height per Plant at Maturity (cm): Mean values and analysis recorded for plant height, revealed that different cultivar (varieties) as well as various levels of radiation doses were significant at 5% level of probability while the interaction between the varieties and gamma irradiation doses were non-significant.

Table 1.6 Effect of Gamma Radiation on Stem Height per Plant is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	53.50	62.34	57.91
T2 (10 KRAD)	57.84	63.67	60.75
T3 (15 KRAD)	47.34	64.17	55.75
T4 (20 KRAD)	46.17	63.67	54.92
T5 (25 KRAD)	43.34	57.50	50.42
MEAN	49.64 a	62.27 b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



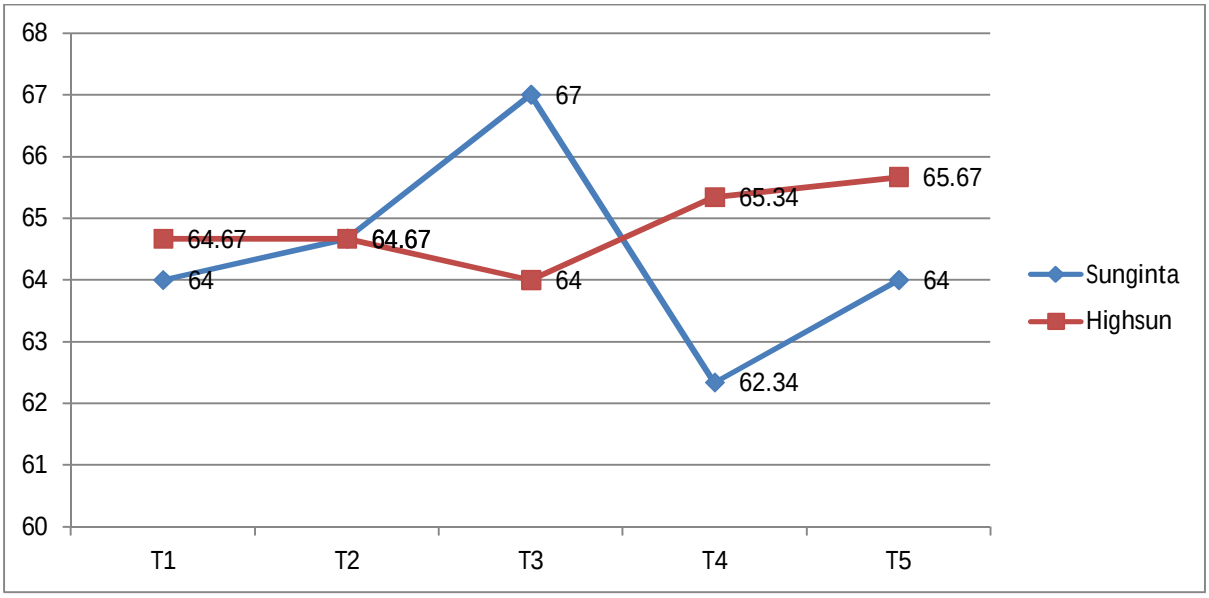


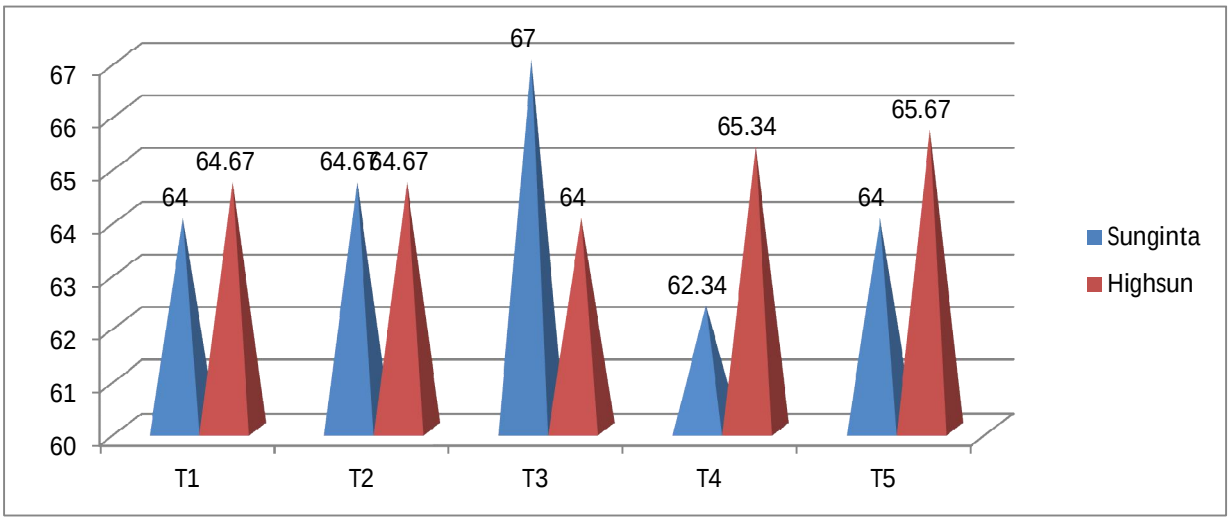
1.7 Days to First Flowering: The mean values and analysis sealed for parameter Days to first flowering showed greater variation in the period of first flowering for both the varieties of sunflower. The average values preserved for this parameter depicted that the different varieties of sunflower under different gamma irradiation doses were non-significant at 5% level of probability whereas the interaction between the varieties and irradiation doses were highly significant.

Table 1.7 Effect of Gamma Radiation on the First Flowering is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	64.00	64.67	64.34
T2 (10 KRAD)	64.67	64.67	64.67
T3 (15 KRAD)	67.00	64.00	65.50
T4 (20 KRAD)	62.34	65.34	63.84
T5 (25 KRAD)	64.00	65.67	64.84
MEAN	64.40 a	64.87	

Means followed by similar letter (s) are non-significant at 5% level of probability.



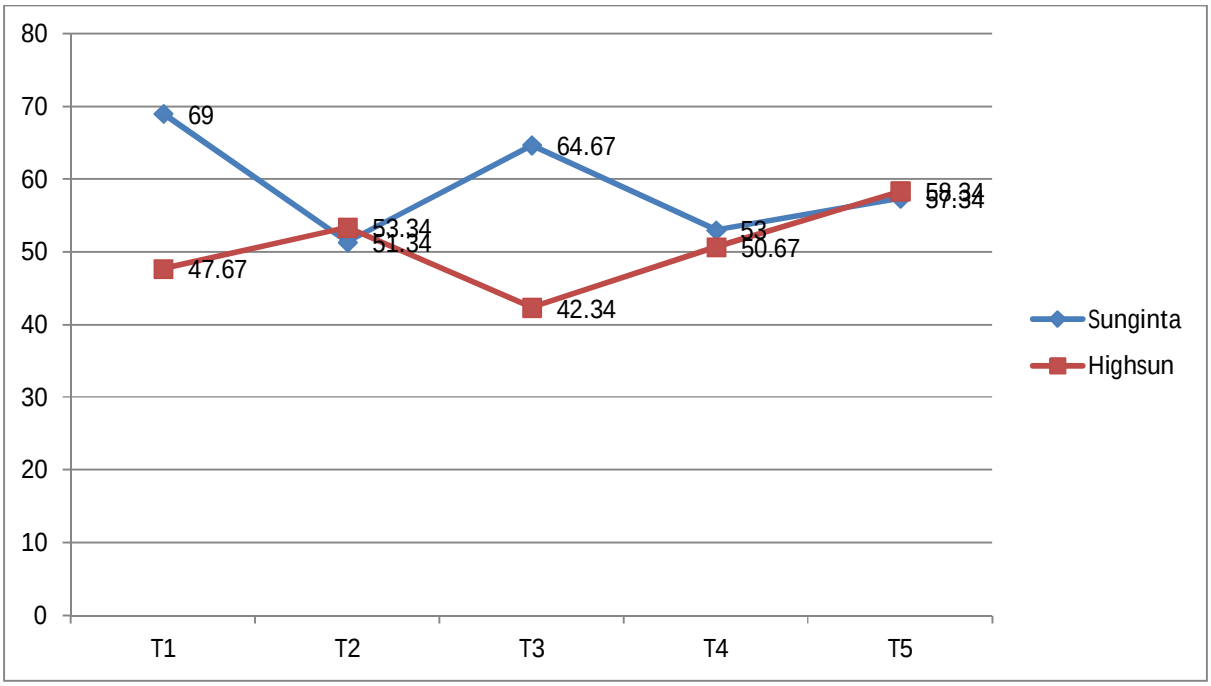


1.8 No of Sepals per Plant Inflorescence: The mean values for No of Sepals per Plant predict that both the varieties of sunflower under different gamma irradiation doses as well as their interaction showed highly significant differentiation from each other at 5% level of probability.

Table 1.8 Effect of Gamma Radiation on No of Sepals per Plant Inflorescence is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	69.00	47.67	58.34
T2 (10 KRAD)	51.34	53.34	52.34
T3 (15 KRAD)	64.67	42.34	53.50
T4 (20 KRAD)	53.00	50.67	51.84
T5 (25 KRAD)	57.34	58.34	57.84
MEAN	59.07 a	50.47b	

Means followed by similar letter (s) are non-significant at 5% level of probability.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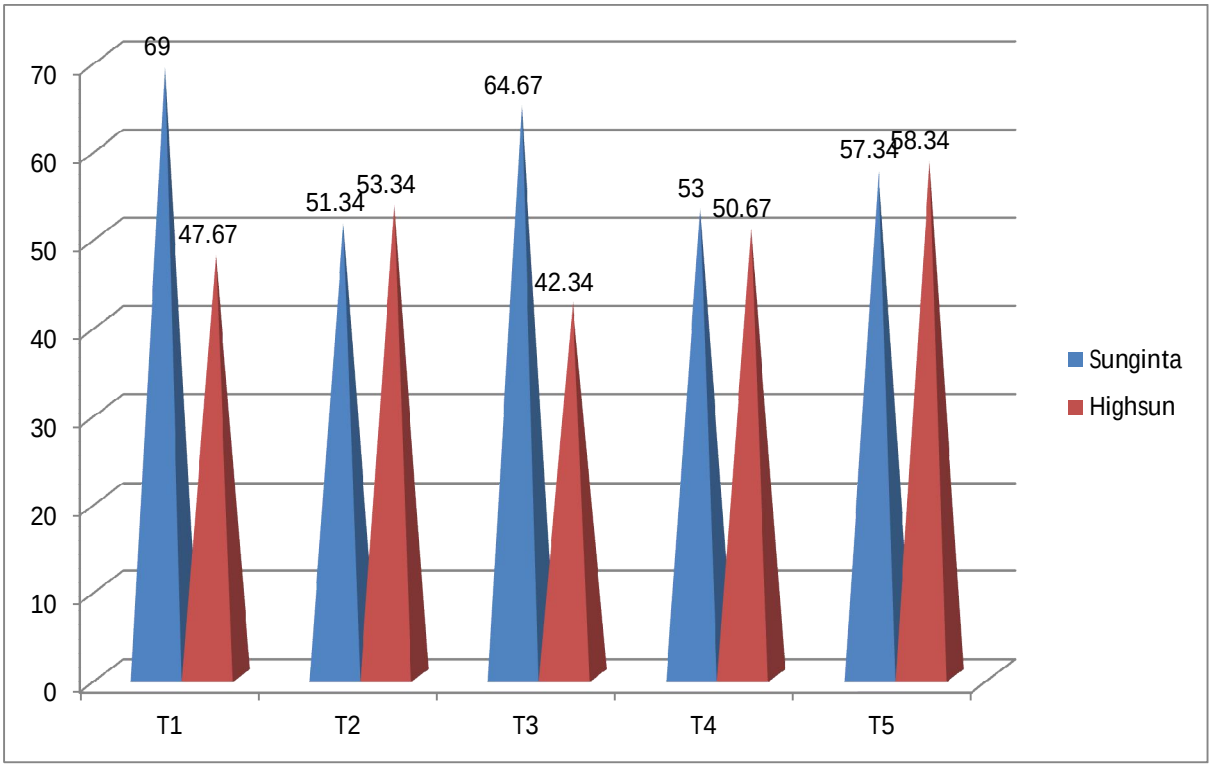
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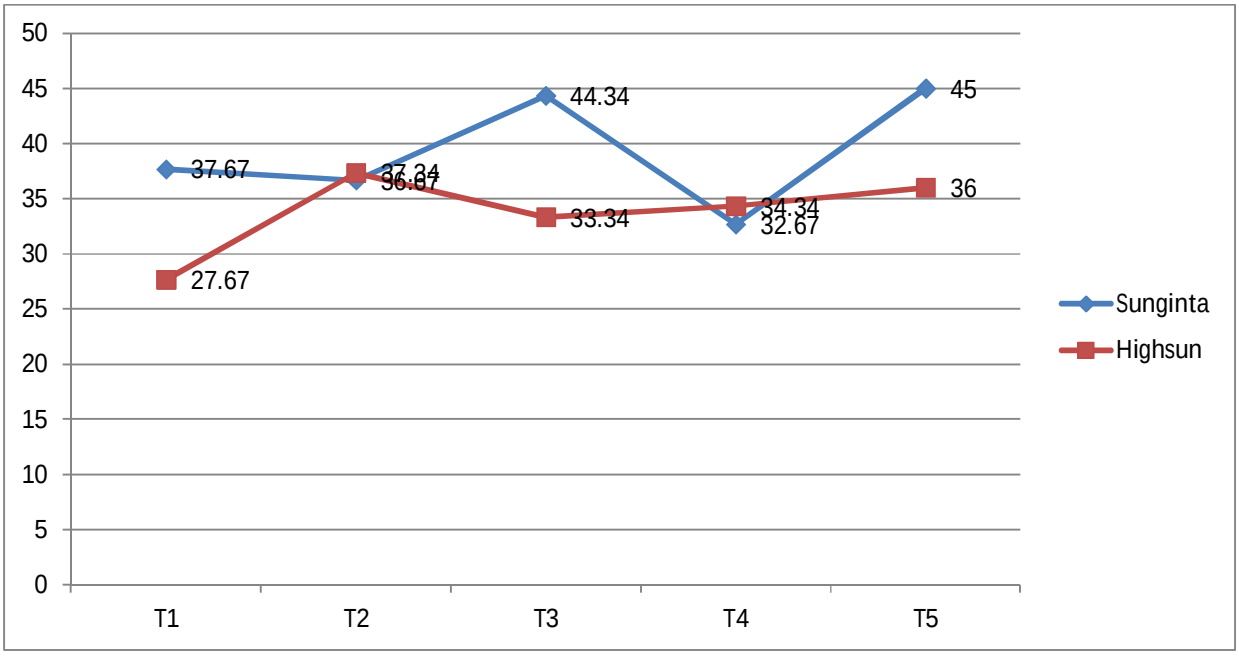
T5
Sunginta
Highsun

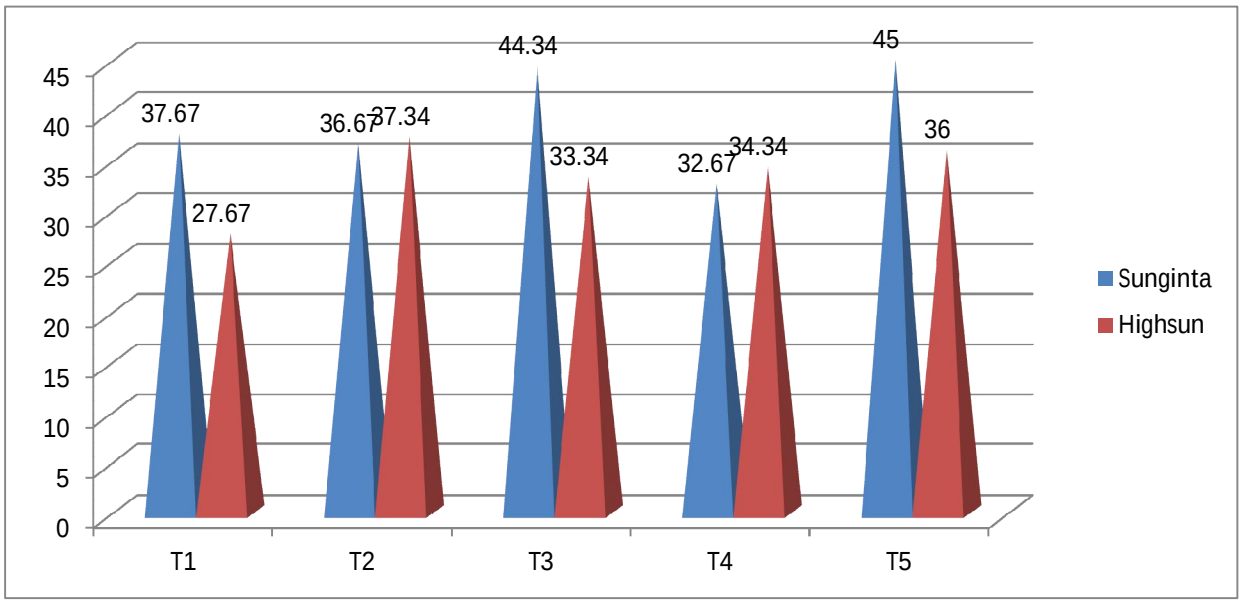
1.9 No of Petals per Plant Inflorescence: The mean value calculated for parameter No of Petals per plant showed a very significant differentiation in both the varieties under different irradiation doses at 5% level of probability and it also predicts that the interaction between the varieties and gamma irradiation doses were also significant.

Table 1.9 Effect of Gamma Radiation on No of Petals per Plant Inflorescence is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	37.67	27.67	32.67
T2 (10 KRAD)	36.67	37.34	37.00
T3 (15 KRAD)	44.34	33.34	38.84
T4 (20 KRAD)	32.67	34.34	33.50
T5 (25 KRAD)	45.00	36.00	40.50
MEAN	39.27 a	33.74 b	

Means followed by similar letter (s) are non-significant at 5% level of probability.



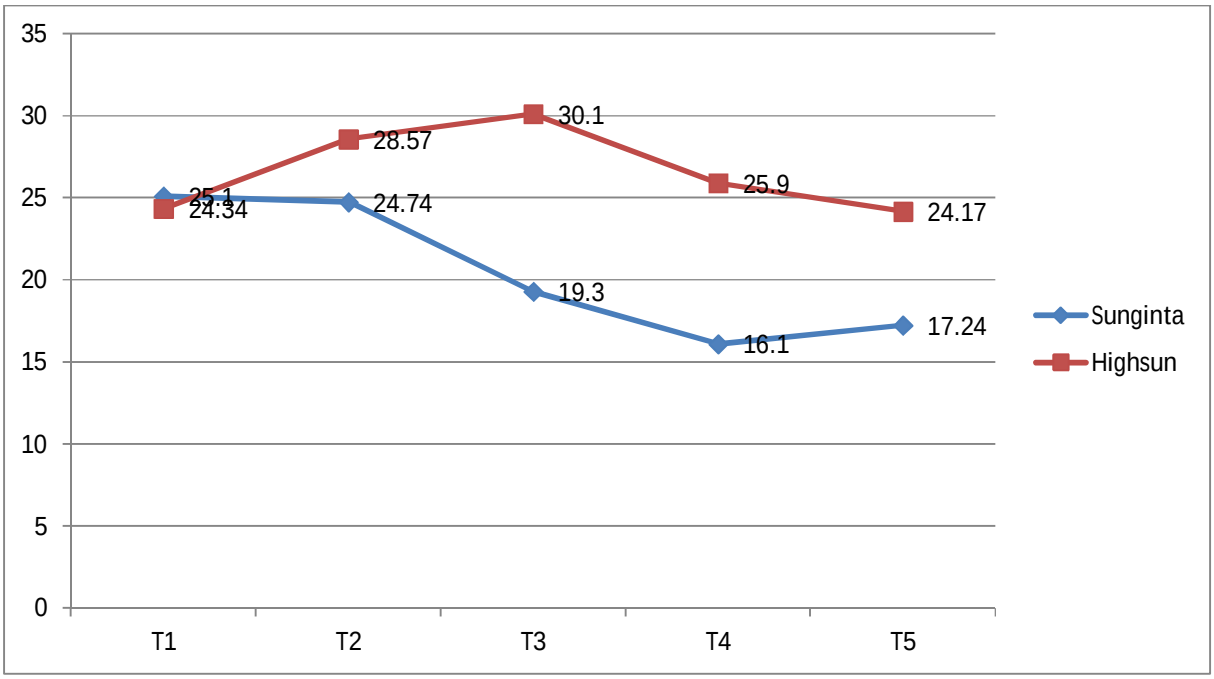


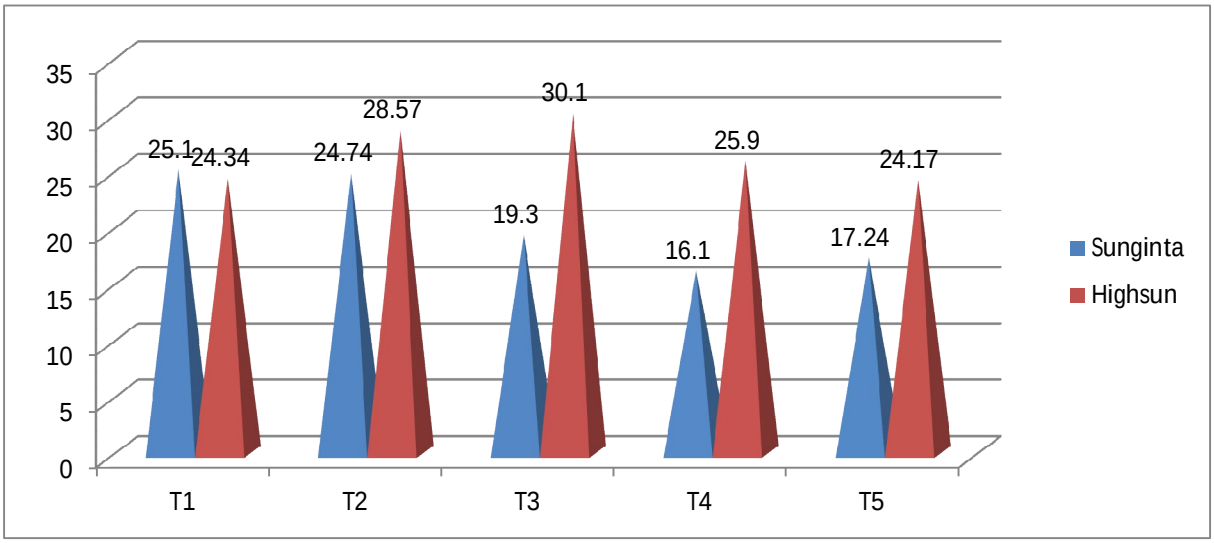
1.10 Flower Head width (diameter): Mean values for parameter flower head width (diameter) showed that the varieties of sunflower under different gamma radiation doses were significant at 5% level of probability while their interaction was non-significant.

Table 1.10 Effect of Gamma Radiation on Flower Head Diameter is given below

TREATMENTS	SYNGENTA	HIGHSUN	MEAN
T1 (CONTROL)	25.10	24.34	24.72
T2 (10 KRAD)	24.74	28.58	26.65
T3 (15 KRAD)	19.30	30.10	24.70
T4 (20 KRAD)	16.10	25.90	21.00
T5 (25 KRAD)	17.24	24.17	20.70
MEAN	20.50 a	26.62 b	

Means followed by similar letter (s) are non-significant at 5% level of probability.





CONCLUSION

- Seedling emergence or germination percentage was noted as maximum when it was treated with 10Krad gamma radiation. However germination percentage of control (non-irradiated) seed was comparatively greater. Seedling emergence of Highsun variety of sunflower was noted to be more than Syngenta variety.

- Minimum number of leaves was noted for Syngenta variety of sunflower, irradiated with 10Krad gamma radiation. Similarly the control plants also responded with minimum number of leaves. Whereas maximum number of leaves were recorded for Highsun variety of sunflower irradiated with 15Krad gamma radiation.

- Width of leaves was observed as minimum in case of Syngenta variety of sunflower, irradiated with 15Krad of gamma rays which was followed by 10Krad treated plants and control plants of both the varieties. While maximum width of leaves were noted for Highsun variety of sunflower, treated with 15Krad of gamma radiation.

- Length of leaves was noted also as minimum for 20Krad treated plant of Syngenta variety of sunflower and was followed by control plants of both the varieties. While the maximum length of leaves were recorded for Highsun variety of sunflower, treated with 15Krad of gamma radiation.

- Maximum length of petiole was noted for Highsun variety of sunflower irradiated with 15Krad gamma radiation and was followed by 25Krad and 20Krad gamma irradiated plants of both the varieties of sunflower.

- In case of Stem height which was observed as maximum for Highsun variety of sunflower, irradiated with 15Krad gamma rays and was followed by 20Krad irradiated plants while the normal plants had minimum length of plant stem.

- Maximum days to first flowering were noted for Highsun variety, irradiated with 25Krad gamma radiation and were followed by 20Krad and 15Krad irradiated plants of both the varieties.

- Number of Sepals and Petals were recorded maximum for Highsun variety of sunflower, irradiated with 15Krad gamma radiation which were followed by the control or non-irradiated, 25Krad and 20Krad irradiated plants respectively.

- Maximum flower head diameter was recorded for Highsun variety of sunflower irradiated with 15Krad gamma radiation and was followed by 20Krad and 10Krad irradiated plants of both the varieties of sunflower.

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