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**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Effect an Extent of Various Leaf Incisions Treatments at Different Growth Stages on the Performance of Sunflower (*Helianthus annuus*)

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**Abstract:** An experiment was conducted at Malakandher Research Farm, NWFP Agricultural University Peshawar during the summer season of 1996. The experiment was laid out in split-plot arrangement in Randomized Complete Block (RCB) design in 3 x 3 m<sup>2</sup> sub-plot with four replications. The objective of this study was to evaluate the adverse losses often occurred by natural disasters i.e hails storms, wind storms & insect pest to sunflower, determined through the artificial induction of leaf incision at different growth stages for the plant height at maturity, No of leaves per plant, days to 50% flowering, Days to maturity, Disc diameter & number of grains per disc. On average of all treatments carried out, (I<sub>1</sub>), two holes per leaf at early four leaf stage (S<sub>1</sub>), resulted in significantly higher plant height and the No of grains per head significantly decreased to 1239 with (I<sub>1</sub>), tow holes per leaf from that of (I<sub>7</sub>), control i.e 1677 seeds per head.

**Key words:** Sunflower, *Helianthus annuus*, growth stages, leaf incisions, performance, Pakistan

### Introduction

Sunflower (*Helianthus annuus*) a famous member of the family composite is the crop of arid & semi-arid areas of the world. In Pakistan its entry as an economical plant dates back to late fifties when it was planted at the former Punjab Agriculture College and Research Institute, Faisalabad.

On Commercial scale it was first planted on area of 592 ha, producing 355 tones of seed with an average yield of 600 kg ha<sup>-1</sup> during the year 1972 -80. This was increased to a level of 43112 ha, producing 42531 tones in 1987-88. Sunflower is the second most important oilseed crops of the World. In Pakistan oil crop producing is very low and Pakistan is facing chronic shortage edible oil. There are some many natural factors involved in damaging of sunflower performance but the important ones are hails storm, wind storms and insect pest attack. So to evaluate these losses, numerous types of experiments had been conducted by scientists. As Beer reported that sunflower plants were subjected to 0, 25, 75 and 100% defoliation at 1 of 7 vegetate or 3 reproductive stages. Seed yield was not generally affected by 25% defoliation. But at 50% decreased with defoliation at stages V<sub>2</sub> and R<sub>2</sub> with progressively increasing effect at higher rates with respect both to yield and stage of defoliation. 100% defoliation at stages V<sub>2</sub> and R<sub>2</sub> marketedly reduced seed weight and oil content and at stages V<sub>2</sub> and R<sub>2</sub> marketedly increased stem height.

Similarly, Nyorko (1985) conducted that defoliation decreased the grain yield and dry matter accumulation. Removal of all leaves decreased grain yield by 80%, removal of top half leaves by 33% and removal of bottom half leaves by 25%.

In other experimental study Singh and Khan (1981) reported that the removal of all the leaves, 8 and 15 leaves either from the top or from the bottom of 50 or 70 days old sunflower plants reduced the diam of the flower head, number of seeds per head and seed yield, complete defoliation produced the greatest effects. The partial defoliation produced greatest and least effects when the 15 top and bottom leaves respectively were removed. So in the present study it was determined throughout he artificial induction of leaf injuries of sunflower crop to called the information about the aforementioned losses occurring often through the natural disasters i.e hails storms, wind storms and insect pests attack. So, hard work is needed to find out ways and means in order to meat the challenge of teeming population. It is possible to achieve this aim if;

1. Improved Production Technology is owned.

2. Adaptation of high yielding, insect/pest resistant varieties and better marketing facilities are made available.
3. Total acreage under oilseed crops is increased.

In the present study it was determined through the artificial induction of leaf injuries of sunflower crop, the adverse losses often occurred to the sunflower crop through the various natural disasters i.e hails storms, wind storms & insect, pest attack.

### Materials and Methods

An experiment to study the effect of leaf incisions at various growth stages on the performance of sunflower was conducted at Malakandher farm NWFP Agricultural University Peshawar during 1996.

The experiment was laid out in RCB split-plot arrangement with four replications in a net plot area of 3 x 3 m<sup>2</sup>. The plots were fertilized thoroughly at the rate of 100, 55 NP kg ha<sup>-1</sup>. The variety used in experiment was iritar. All cultural practices were uniformly carried out except the given variables. Variables were;

- (a) Two holes per leaf (I<sub>1</sub>), Four holes per leaf (I<sub>2</sub>), two full slits per leaf (I<sub>3</sub>), Four full slits per leaf (I<sub>4</sub>), Two half slits per leaf (I<sub>5</sub>), Four half slits per leaf (I<sub>6</sub>), control (I<sub>7</sub>), while
- (b) Growth stages in sunflower were early four leaf stage (S<sub>1</sub>), star formation stage (S<sub>2</sub>), Flowering stage (S<sub>3</sub>) & Milk stage (S<sub>4</sub>). Data were collected on plant height at maturity (cm), number of leaves per plant, Days to 50% flowering, Days to maturity, Disc diameter and number of grains/head which was statistically analyzed and LSD test was applied for determination of goodness of any treatment.

In view of the present research study, Banerjee and Haque (1984) reported that extensive defoliation (70-90%) of sunflower variety EC 68414 by late instar larvae of *Diacrisia Casingneta* over 14 days in field plot tests in index caused substantial losses in seed quality and yield. The consequent rapid reduction in the overall photosynthetic area resulted in a slender stem and small thalamus. Defoliated plants produced 28.3% fewer healthy and 55.7% were shriveled seed than did control plants.

### Results and Discussion

The data recorded in Table 1 and analysis of variance shows

Khan *et al.*: Leaf incisions at different growth stages of sunflower

Table 1: Plant height (cm) as affected by various leaf incision treatment at different growth stages in sunflowers

Leaf incisions	Early four leaf stage S <sub>1</sub>	Star formation stage S <sub>2</sub>	Flowering stage S <sub>3</sub>	Milk S <sub>4</sub>	Mean
I <sub>1</sub>	192.08 a	185.41 cd	189.00 b	187.83 bc	188.58 A
I <sub>2</sub>	183.16 d	181.66 de	190.16 b	187.83 bc	185.54 B
I <sub>3</sub>	180.6 de	183.91 d	183.33 d	184.91 bc	183.20 B
I <sub>4</sub>	176.33 fg	177.00 fg	179.75 ef	175.75 fg	177.21 C
I <sub>5</sub>	177.33 fg	173.91 h	179.58 ef	184.83 d	178.91 C
I <sub>6</sub>	169.25 i	185.25 cd	179.66 ef	187.33 bc	180.37 D
I <sub>7</sub>	180.92 de	190.00 b	183.91 d	173.08 h	181.98 D
Means	179.96	182.45	183.63	182.98	

Means of the same category followed by different letters are significantly different from one another at 5% level of probability using LSD test.

Treatments

Leaf incisions,

I<sub>1</sub> = Two holes/leaf

I<sub>2</sub> = Four holes/leaf

I<sub>3</sub> = Two full slits/Leaf

I<sub>4</sub> = Four full slits/Leaf

I<sub>5</sub> = Two full slits/Leaf

I<sub>6</sub> = Four half slits/Leaf

I<sub>7</sub> = Control

Table 2: Number of grains/disc or head as affected by various leaf incision treatments at different growth stages in Sunflower

Leaf incision	Early four leaf Stage	Star formation stage	Flowering stage	Milk Stage	Mean
I <sub>1</sub>	1357.26jk	1539.43bf	1230.50 l	1556.45 b-e	1420.91
I <sub>2</sub>	1504.48 e-h	1763.23 a	1405.05 h-k	1455.32 e-j	1532.02
I <sub>3</sub>	1433.31 f-j	1627.91 bc	1429.01 g-k	1469.04 e.i	1489.82
I <sub>4</sub>	1322.76 kl	1517.97 a-h	1376.01 ijk	1428.92.gk	1409.55
I <sub>5</sub>	1529.83 cg	1510.97 bh	1486.49 dh	1450.53 ej	1494.45
I <sub>6</sub>	1450.50 e.j	1496.66 e.h	1384.92 ik	1402.08 h.k	1424.54
I <sub>7</sub>	1647.31b	1798.07 a	1648.31 b	1616.22 bcd	1677.48
Mean	1463.63	1606.69	1417.76	1482.65	

Mean of the same category followed by different letters are significantly different from one another at 5% level of probability uses LSD test.

that leaf incisions and their interaction (IXS) with growth stages in sunflower had significantly affected plant growth while stage of growth were non-significant. Plant height in sunflower seemed to be increased with leaf incisions.

Taller plants of 188.57 cm were recorded with two holes per leaf (I<sub>1</sub>) followed by four holes per leaf (I<sub>2</sub>) with 185.53 cm tall plants while control (I<sub>7</sub>) had 181.97 cm tall plants the reason may be attributed to the photosynthesis disturbance due to incision, so the planted got maximum height but drastically affected the canopy of the plant than that of the control, non-injured plants which gained full canopy and were lower in height (Mariko and Hogesto, 1987).

Similarly by the interaction of both variables (IxS) plant height was greatly assessed during the early growth stage of sunflower, because the injured plants at early stage of growth badly affected the plant height due to the sensitivity of the very young plants to the leaf injury (Fleck and Vidal, 1989-90). However, the leaf incision at different growth stages in sunflower crop had not produced any such significant result in data collected for no. of leaves per plant, days to 50% of lowering, days to maturity and disc diameter while the number of seeds/head were significantly affected by the leaf incisions and by their interaction with growth stages.

The data recorded in Table 2 and analysis of variance shows that leaf incisions and their interaction with (IxS) with growth stages in sunflower had significantly affected the number of grains per head. The number of gains per head in sunflower crop decreased from 1677.0 seed/head (I<sub>7</sub>) control to the number of 1239 seeds/head resulted with leaf incision of (I<sub>1</sub>)

two holes per leaf. While as regarding of interaction (IXS) highest number of 1798 seeds/head were recorded with (I<sub>7</sub>) control at star formation stage (S<sub>2</sub>) while the minimum number of 1239 seeds/head were resulted with the (I<sub>1</sub>) two holes per leaf at flowering stage (S<sub>3</sub>) of sunflower crop. The possible reason might be that the plants which were non-injured (I<sub>7</sub>) gained full canopy, leaves were broader in shape, interception of sunlight was good essential for the most important process of photosynthesis, better translocation of assimilates from the leaves towards the head through the active process resulted in the greater no. of filled grains per head as compared to the injured incised crop plants (Schneiter and Johnson, 1994).

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