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# Influence of Sowing Date on Growth and Yield Components of Sunflower *(Helianthus Annuus L.)* in Semi-Arid Zone

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**Abstract**

The main objective of this study was to quantify the influence of sowing date on growth and yield components of hybrid sunflower (Hysun33) cultivar in semi-arid zone. This experiment was conducted during the seasons 2014/2015-2015/2016 at the farm of the College of Agricultural Studies, Sudan University of Science and Technology, Shambat, Khartoum- Sudan. The experiment was arranged in randomized complete block design (RCBD) with four replications and three treatments. Different parameters were considered including plant height, leaf area index (LAI), filled sees number/head, head diameter, dry weight and yield components. The collected data were statistically analyzed. The results revealed that crop sown in May and July showed significant increase in plant height, LAI, head diameter, dry weight, field seed number/head, weight of 100 seeds; yield; and yield components; compared to crop sown in March. However, crop sown in the second season showed an increase in growth and yield components compared to the crop of the first season.

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## Introduction

Sunflower (*Helianthus annuus* L.) belongs to family Compositeae. It is a native to Central America, and seemingly; it is Peruvian or Mexican in origin [1, 2].

The economic importance of this crop is that the fresh green plant can be used as silage or fodder to feed livestock. The seed can be eaten raw or roasted, and it can be used in salads, cooking, margarine, lubricant, paint varnishes and soap production. The seed contains about 36 to 45 % oil depending on the variety [3].

The crop is categorized as a low to medium drought sensitive [4]. It shows adaptability to different regions, climatic conditions and sowing dates due to its high genotype and ambient interactions [5]. Therefore it can be grown twice a year [2]. Nevertheless, despite the ability of the crop to high water use, and the ability to withstand short periods of severe soil water deficit of up to 15 atmosphere tension, the long periods of severe soil water deficit, particularly at water-sensitive growth stages, causes significant reduction in seed yield [6].

It is noticed that good cultural practices and drainage are required for sunflower production [7]. However; several studies reflected that sunflower can be grown at a wide range of dates. Most cultivars are early maturing. In areas where no winter, sunflower can be grown at any month of the year to obtain satisfactory yields [8, 9].

It is reported that yield differences between hybrids with regard to sowing time and density are remarkable. These differences are determined on one hand by the hybrid characteristics and environmental conditions, and on the other hand, on by plant population, soil fertility and land preparation [8, 9].

Researchers [10] showed that when sunflower sown in December; it flowers between March and April, at a time when the honeybee activity is maximum, resulting in better pollination and consequently good seed setting.

Seed setting and filling problem is one of the most important constraints in sunflower production, especially under rain-fed; where the heavy rains wash the pollen grains, and often considered to be a major reason for low productivity [11].

## Materials and Methods

This experiment was conducted at the farm of the College of Agricultural Studies, Sudan University of Science and Technology, Shambat, Khartoum - Sudan, during the seasons 2014/2015 and 2015/2016. Where the climate is described as semi-arid region. The area receives an average annual rainfall in summer, during July to September, ranging from 100 to 160 mm/annum, and relative humidity ranges between 31-51% during the wet season and 12-27% during the dry season. The average maximum and minimum temperature is about 41.7 $^0$C and 15.3 $^0$C respectively. The winter season begins in November and ends in March. It is relatively cool and dry [12].

The soil of study area is classified as silt, clay loam with non saline at surface, but slightly sodic at the subsurface.

The adopted experimental design was the randomized complete block (RCBD); with four replications and three treatments [sowing dates (March, May and July)] which referred as $S_1$, $S_2$ and $S_3$ respectively.

The land was cleared, well prepared by using disc plough, disc harrow, leveler and moldboard. Then the area was divided into equal plots. Each plot size is 4 X 4 m$^2$, with 5 rows. The spaces between rows are 70 cm. Following the randomization, seeds of sunflower (Hysun 33) were sown on rows, 70X15 cm apart. The recommended cultural practices by the Research Centre in Sudan were followed.

The data of the studied parameters were collected. Where three plants were randomly selected from each plot for measuring the following parameters: plant height (cm), leaf area index (LAI), plant dry weight (g), and yield components including head diameter, 100 seeds weight (g), number of seeds/head, yield (t/ha). The collected data were subjected to statistical analysis using statistic 8, Version 2.0 UK.

## Results

Table 1. Effect of sowing date on Plant height (cm), Leaf Area Index (LAI)($cm^2$), filled seed number/ head– Shambat- Khartoum, Sudan (2014/2015 and 2015/2016).

| Sowing Date | Season1 | | |
|---|---|---|---|
| | Plant height (cm) | Leaf area Index (L. A I) | Filled seed No. /head |
| S1 | $131.15^{AB}$ | $94.45^{B}$ | $235.54^{A}$ |
| S2 | $136.55^{A}$ | $81.59^{C}$ | $152.75^{C}$ |
| S3 | $128.46^{B}$ | $106.13^{A}$ | $186.69^{B}$ |
| SE+ | 4.04 | 6.51 | 15.63 |
| CV | 8.23 | 11.10 | 31.79 |
| Season11 | | | |
| S1 | $125.50^{C}$ | $74.26^{C}$ | $240.04^{C}$ |
| S2 | $135.84^{A}$ | $137.31^{A}$ | $289.38^{B}$ |
| S3 | $129.49^{B}$ | $109.57^{B}$ | $316.19^{A}$ |
| SE+ | 3.08 | 6.60 | 45.36 |
| CV | 6.26 | 13.42 | 32.29 |

Means in columns followed by different letters are significantly different at 5 %. HyS33= Hysun33 Cultivar. S1= Sowing in March. S2= Sowing in May. S3= Sowing in July.

Table 2. Effect of sowing dates on 100 seeds weight, head diameter (cm), Plant dry weight (g) and Yield t/ha Shambat- Khartoum, Sudan (2014/2015 and 2015/2016).

| Season I | | | | |
|---|---|---|---|---|
| Sowing date | 100 seed Weight (g) | Head diameter (cm) | Plant dry weight (g) | Yield t/ha |
| S1 | $3.89^{B}$ | $8.38^{B}$ | $365.00^{B}$ | $1.13^{C}$ |
| S2 | $4.20^{A}$ | $9.46^{A}$ | $435.00^{A}$ | $1.13^{B}$ |
| S3 | $4.38^{A}$ | $9.42^{A}$ | $378.13^{B}$ | $1.57^{A}$ |
| SE+ | 0.30 | 0.44 | 40.42 | 5.88 |
| CV | 0.61 | 0.89 | 52.19 | 11.96 |
| Season II | | | | |
| S1 | $1.59^{A}$ | $8.85^{C}$ | $201.88^{B}$ | $0.67^{B}$ |
| S2 | $1.32^{B}$ | $12.38^{A}$ | $205.00^{B}$ | $0.78^{A}$ |
| S3 | $1.33^{B}$ | $11.19^{B}$ | $262.50^{A}$ | $0.71^{B}$ |
| SE+ | 0.14 | 0.41 | 35.48 | 16.30 |
| CV | 0.29 | 0.84 | 42.24 | 33.15 |

Means in columns followed by different letters are significantly different at 5 %. HyS33= Hysun33 Cultivar. S1= Sowing in March. S2= Sowing in May. S3= Sowing in July.

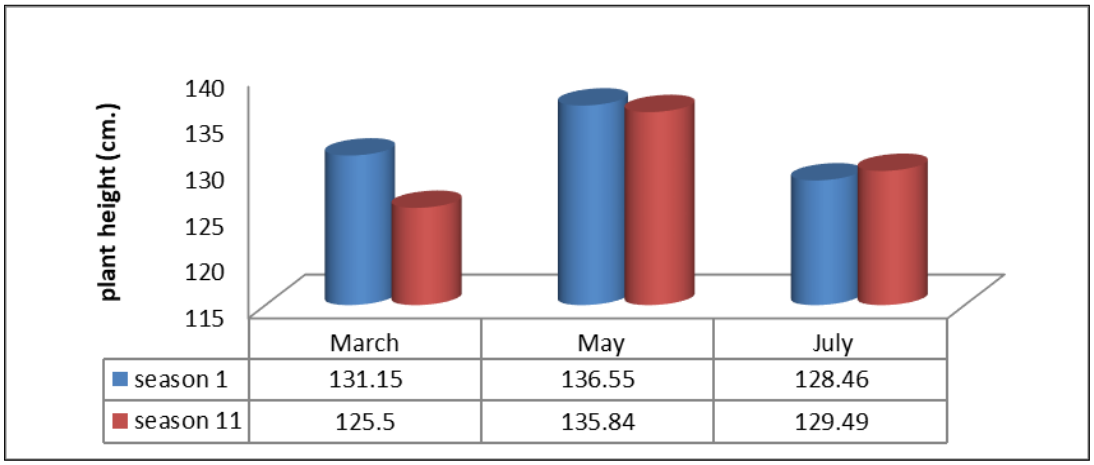


Figure 1. Effect of sowing date on plant height (cm.)- Khartoum-Sudan(2014/ 2015-2015/2016).

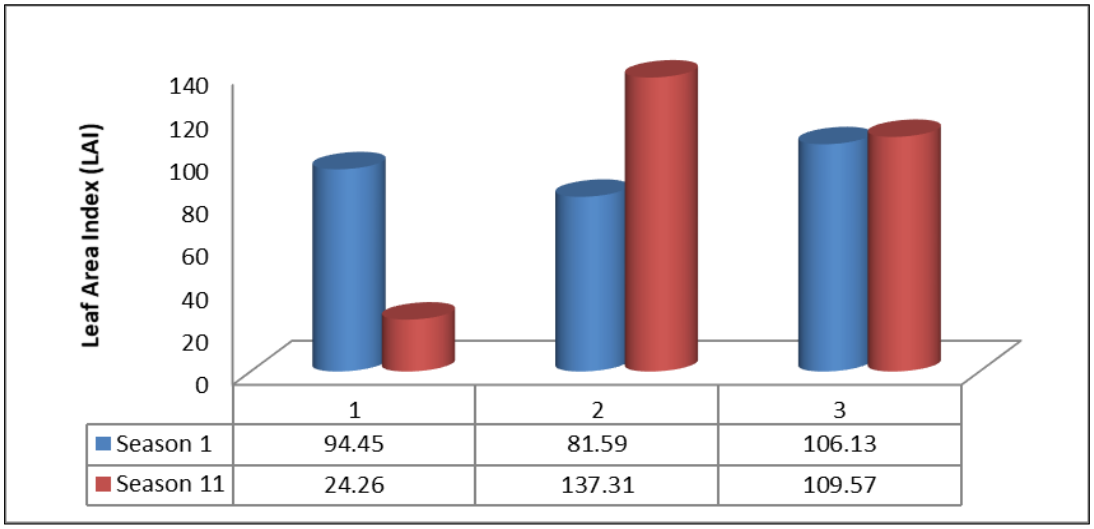


Figure 2. Effect of sowing date on Leaf Area Index (LAI.)- Khartoum-Sudan (2014/ 2015-2015/2016).

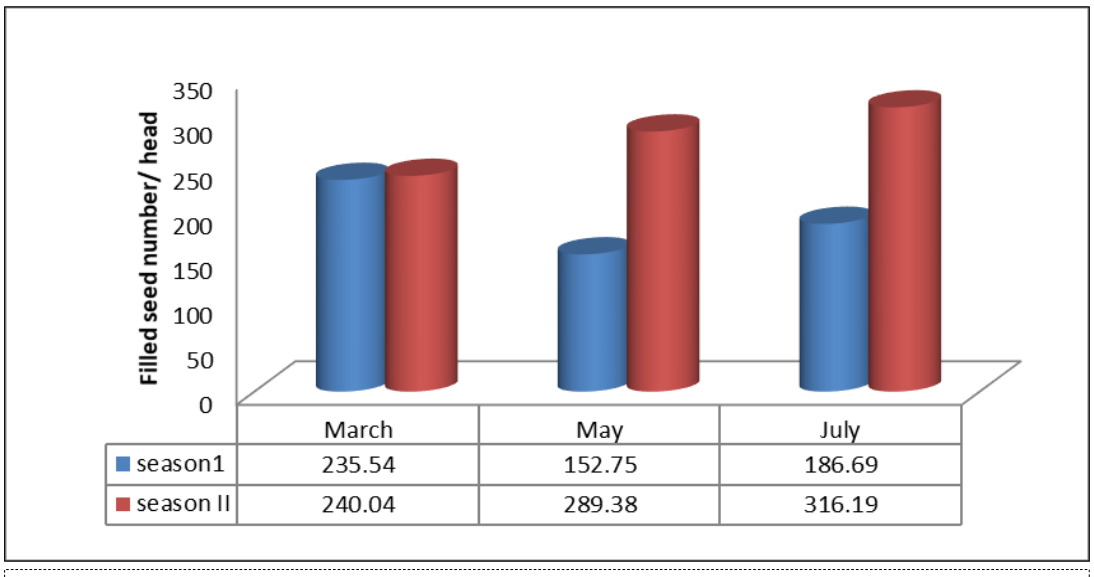


Figure 3. Effect of sowing date on filled seed number/head - Khartoum-Sudan (2014/ 2015-2015/2016).

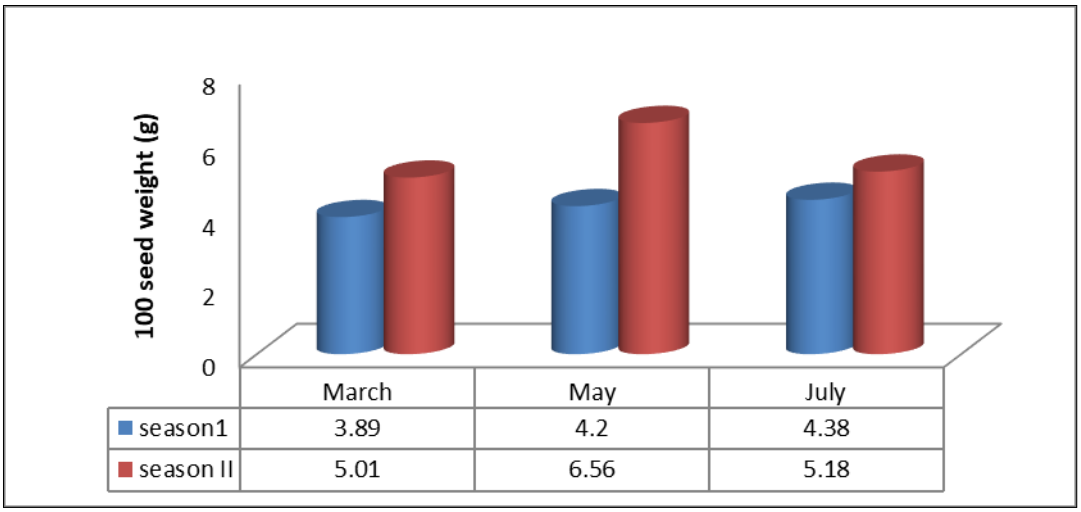


Figure 4. Effect of sowing date on 100 seed weight (cm.)- Khartoum-Sudan (2014/ 2015-2015/2016).

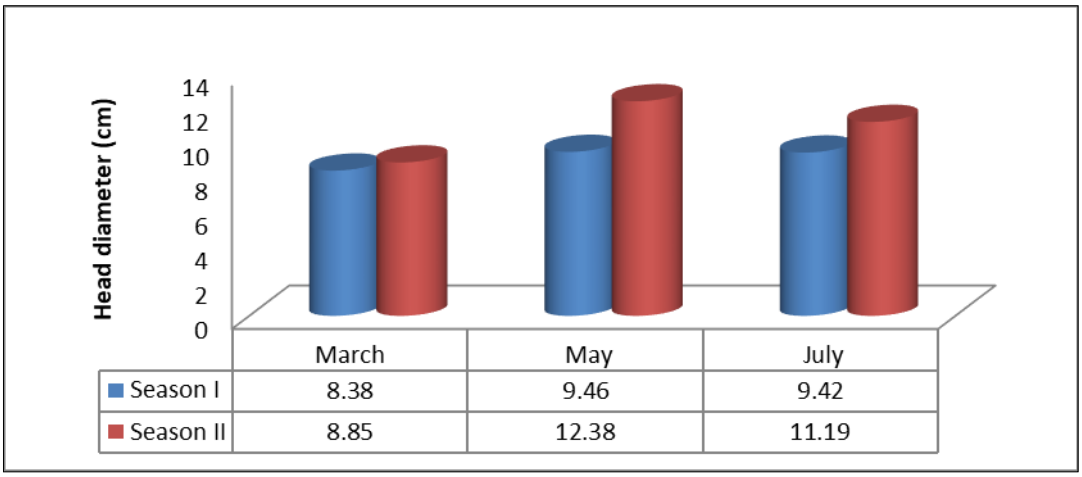


Figure 5. Effect of sowing date on head diameter (cm.)- Khartoum-Sudan (2014/ 2015-2015/2016

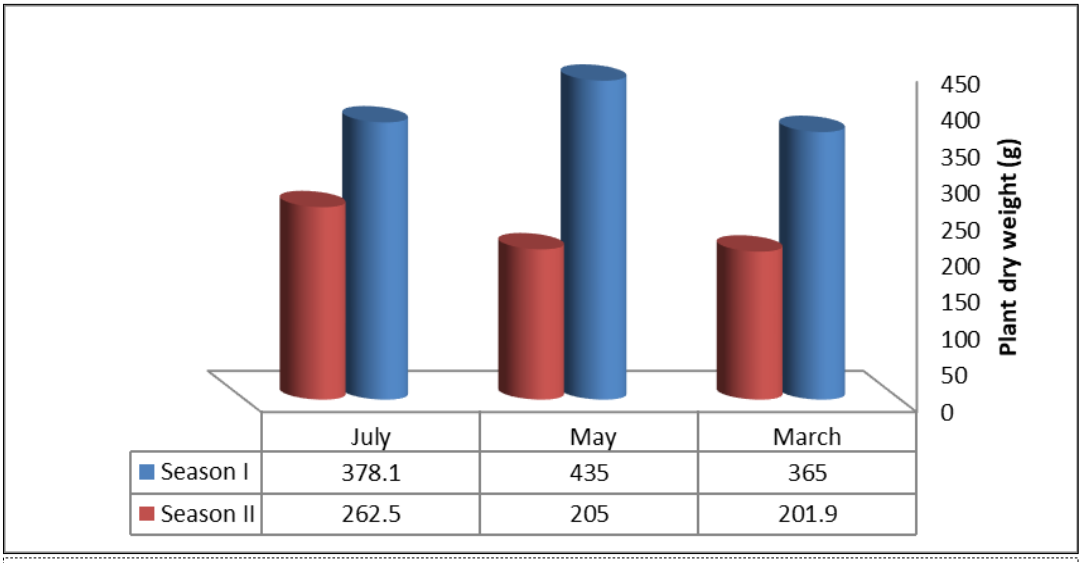


Figure 6. Effect of sowing date dry weight (g) - Khartoum-Sudan (2014/ 2015-2015/2016).

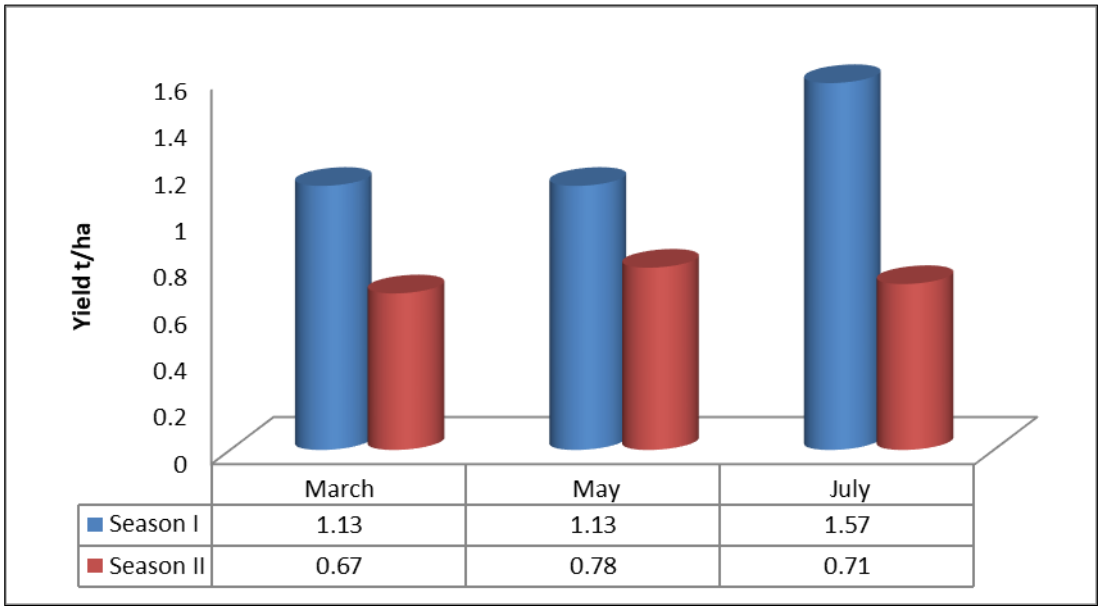


Figure 7. Effect of sowing date on yield ton/ha (2014/2015 and 2015/2016).

**Discussion**

Considering table 1, and Fig.1, the results of data analysis of this study showed variation in plant height for the different sowing dates in the same season as well as between the two seasons. In the first season, crop sown in May ($S_2$) has significantly increased plant height (136.55 cm) compared to January (132.15 cm) and July (128.46 cm), while in the second season plant heights for the different sowing dates were 125.50 cm, 135.84 cm and 129.49 cm for January, May and July respectively. It is clear that sowing date in May ($S_2$), produced the highest plant height in both seasons. A researcher [13]; reported that plant height decreased significantly with delay in sowing from first January, to first April. This result disagrees with the results obtained in this study. This variation may be due to difference in climatic conditions and cultural practices.

As far as the leaf area index (LAI) concern, in the first season, the sowing date $S_3$ produced bigger LAI (106.13 $m^2$) compared to 94.45 $cm^2$ and $S_1$ 59.45 $cm^2$ for $S_1$ and $S_2$ respectively. While in the second season; $S_2$ produced the biggest LA I 137.31 $m^2$, followed by $S_3$ and $S_1$ respectively (Table 1, Fig. 2).

For filled seed number/head, the data reflected $S_1$ produced the highest number of seed filling/head (235.54), followed by $S_3$ and $S_2$ (152.75) in the first season (Table 1, Fig. 3), where in the second season the highest number was obtained by $S_3$ (316. 19) compared to $S_2$ (289.38) and $S_1$ (240.04) (Fig. 2). Similar result was obtained by one of the researcher [14].

For seed weight (100 seeds weight), the sowing dates $S_3$ (4.38g.) and $S_2$ (4.2 g) produced higher seed weight in the first season compared to $S_1$ (3.89 g.). While in the second season; the $S_1$ produced more seed weight compared to $S_3$ and $S_2$ (Table 2, Fig. 4).

In regard to head diameter, $S_2$, and $S_3$ appeared to be the suitable sowing dates for sunflower in this area (Table 2). However, the head diameters for the different sowing dates in different seasons were as follows: for the first season, $S_2$, and $S_3$ produced similar head diameter (9.46 cm, 9.42 cm), while $S_1$ produced head diameter of 8.38 cm. For the second season, $S_2$ (12.38) considered the best sowing date followed by $S_3$ (11.19) and $S_1$ (8.85) (Fig.5).

The data of the dry weight of the first season reflected that treatment $S_2$ showed higher dry weight (435 g) compared to treatment $S_2$ and $S_3$ 375.13 and 365 respectively. While treatment $S_3$ produced more dry weight (262.5 g) compared to treatments $S_2$ (205 g) and $S_1$ (201.85 g) respectively (table 2, Fig.6).

As far as the yield concern, the data displayed variation between and within the two seasons. The yield of the first season exceeded the second season. In the first season; crop sown in July produced higher yield,

while in the second season; crop sown in May produced higher yield (Table 2, Fig 7).

## Conclusion

Sunflower can be cultivated year a record in different region in the world. The performance of sunflower is largely affected by adverse conditions, cultural practices and sowing date.

This Study showed that the optimum sowing dates in the study area are May ($S_2$) and July ($S_3$), when the highest plant height, leaf area index (LAI), number of seed setting/head, weight of 100 seed, head diameter, dry weight were a obtained.

## References

1. Demir A.O., Goksoy A.T., Buyukcangaz H., Turan Z.M., and Koksal E.S. 2006. Deficit irrigation of sunflower (L.) in a sub-humid climate. Irrigation Science. 24: 279-289.
2. Salman A., Muhammad, N. I., Ihteramuarhan, A., Waheed, M. D. and Khilwat A.2012.Plant Breeding and Genetics Division, Nuclear Institute of Agriculture, TandoJam.KPK Agricultural, University Peshawar, Pakistan.
3. Rodriguez,D.J., Romero-Garcia J., Rodriguez-Garcia R., and Angulo-Sanche,J. L.2002.Characterization of proteins from sunflower leaves and seeds: Relationship of biomass and seed yield. In: Trends in New Crops and New Uses (Janick, J. and A. Whipkey, eds). Proc. AAIC Fifth National Symposium, Purdue Univ., USA, pp. 143-149
4. Iqbal,N.,Ashraf, M., Azam, F.,2005. Influence of seed development and seed position on oil, fatty acid and total tocopherol contents in sunflower (L) Turk. J.Agric.29:179-186.
5. Schoeman, L.J., 2003. Genotype and environmentinteraction in sunflower (*Helianthusannus* L.) inSouth Africa.M.Sc Thesis.University of the FreeState. Bloemfontein. South Africa.
6. Beyazgul, M., Kayam, Y., and Engelsman, F. 2000. Estimation methods for crop water requirements in the Gediz Basin of western Turkey. Journal of Hydrology. 229: 19-26.
7. Patel,S.R. and Thakur, D.S. 2003.Effect of crop geometry ,phosphorus levels and phosphate solubilizing bacteria on growth, yield and oil content of sunflower. J. oilseeds Res.,20(1): 153-154.
8. Joksimovic, J., J. Atlagicand, D. Skoric. 1999. Path coefficient analysis of some oil yield components in sunflower (L.). Helia, 22 (31):35-42
9. Vega, A. J. and A. Hall, 2002. Effect of planting date, genotype and their interactions on df sunflower yield: II. Components of oil yield. Crop Sci., 42:1202-1210.
10. Sinha, S.N. and Atwal, S.S. 2000. Pollination requirement in sunflower hybrid seed production:III Effect of methods of pollination on seed setting and yield. Seed Res. 28 (2): 113 – 118.
11. Ram,M. and Davari,M.R.2011.Seed setting and filling problem in sunflower and its management: A review. Int. J. Agron, and Plant Prod.,2(2) ;33-56.
12. Department of Metrology (2015). Khartoum -Sudan,
13. Gulzar Ahmed and ZarQuresh, 2000.Plant Population of Sunflower under Different Planting Dates.Pakistan Journal of Biological Sciences, 3: 1820-1821.
14. Ahmad, S.; Hussan, F.; Ali, H. and Robab, U. 2005.Response of sunflower to dibbling time for yield and yield components. J. Res. (Sci.) BZU, Multan, Pakistan 16 (1): 19 - 26.