The Pharma Innovation Journal 2022; 11(4): 1842-1845

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(4): 1842-1845

www.thepharmajournal.com
Received: 10-01-2022
Accepted: 31-03-2022

**Raju Lal Dhakar**
Department of Agronomy, C.P. College of Agriculture, Sardarkrushinagar Dantiwada Agriculture University, Sardarkrushinagar, Dantiwada, Satsan, Gujarat, India

**AG Patel**
Associate Professor, Department of Agronomy, Agroforestry Research Station, Sardarkrushinagar, Dantiwada Agriculture University, Sardarkrushinagar, Dantiwada, Satsan, Gujarat, India

**Yonika Saini**
Department of Agronomy, C.P. College of Agriculture, Sardarkrushinagar Dantiwada Agriculture University, Sardarkrushinagar, Dantiwada, Satsan, Gujarat, India

**Bhanwar Lal Nagar**
Department of Agronomy, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

**Patel Devika**
Department of Agronomy, C.P. College of Agriculture, Sardarkrushinagar Dantiwada Agriculture University, Sardarkrushinagar, Dantiwada, Satsan, Gujarat, India

**Corresponding Author:**
**Raju Lal Dhakar**
Department of Agronomy, C.P. College of Agriculture, Sardarkrushinagar Dantiwada Agriculture University, Sardarkrushinagar, Dantiwada, Satsan, Gujarat, India

# Effect of sowing dates and row spacing on forage yield of sunflower (*Helianthus annuus* L.)

**Raju Lal Dhakar, AG Patel, Yonika Saini, Bhanwar Lal Nagar and Patel Devika**

**Abstract**
A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of 2020-21 to study the effect of sowing dates and row spacing on forage yield of sunflower (*Helianthus annuus* L.). The experiment consisting twelve treatment combinations comprising four sowing dates (15th October, 1st November, 15th November, 30th November) and three row spacing (15 cm, 30 cm, 45 cm spacing) were evaluated in split plot design with four replications. Results found that sowing of forage sunflower crop in the second fortnight of October produced numerically higher plant height, green forage yield, dry forage yield and nitrogen content. Among the row spacing, significantly higher plant height, green forage yield and dry forage yield was recorded under the 30 cm row spacing as compared to rest of the treatments, whereas lower number of days to 50% flowering was found at 45 cm row spacing. Numerically higher nitrogen content was recorded at 30 cm row spacing.

**Keywords:** Sunflower, sowing dates, row spacing, nitrogen content, days to 50% flowering

## Introduction
Sunflower (*Helianthus annuus* L.) is cultivated on 22 M ha area with the production of about 33 million tonnes and occupied the fourth place in the world (FAO, 2009). India has emerged as second major sunflower producing country in Asia after China. In India, it is mostly grown in the states of Karnataka, Maharashtra, Andhra Pradesh Tamil Nadu and Gujarat. India occupies 2.25 million ha area under sunflower with a production of 1.25 million tonnes which contributes about 10.04 per cent of the world acreage and 6 per cent of world production. Moreover, sunflower can be used as fodder purpose under scarcity so that it is vary essential to optimize the agronomical practices for higher production of sunflower as a forage crop.
Sunflower (*Helianthus annuus* L.) is one of the most important forage crops belongs to the family of Asteraceae. The name *Helianthus* being derived from *helios* (the sun) and *anthos* (a flower). It is known as sunflower as it follows the sun by day, always turning towards its direct rays. The plant has a rough hairy stem, broad coarsely toothed rough leaves and circular heads of flowers (Khaleghizadeh, 2011) [9].
Beside this, sunflower crop fit in too many cropping systems and forms the best candidate for contingency planning. The seeds of sunflower contain oil and are used as important source of vegetable oil for food. Whereas, sunflower oil cake is used for livestock and poultry feeding. The sunflower oil is also used in soap and paints. The seeds may be eaten dried, roasted and also used in birdseed mixes. The leaves are used as fodder; hulls are used as roughage in animal food and also as litter for livestock.

## Materials and Methods
A field experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *rabi* season of 2020-21. The soil of experimental field was loamy sand in texture with low in organic carbon (0.20%) and low in available nitrogen (179.8 kg/ha), medium in available phosphorus (48.6 kg/ha) and potash (272 kg/ha) having pH value of 7.48. The experiment consisting of twelve treatment combinations comprising four sowing dates *i.e.*, $D_1$: 15$^{th}$ October, $D_2$: 1$^{st}$ November, $D_3$: 15$^{th}$ November and $D_4$: 30$^{th}$ November and three levels of row spacing treatments i.e., $S_1$: 15 cm, $S_2$: 30 cm and $S_3$: 45 cm were evaluated in Split Plot Design with four replications.

**Plant height (cm)**
The periodical plant height at 20, 40, 60 DAS and at harvest was measured from the ground level to the top of the main shoot of plants. Average values of the five plants were computed and recorded as plant height.

**Days to 50 per cent flowering**
The days required from sowing to 50 per cent flowering in each net plot were observed visually and recorded as days to 50 per cent flowering.

**Green forage yield (q/ha)**
First the ring line of each plot was harvested and collected outside of the experimental site. Then, the plants from the net plot were harvested about 2-3 cm above the ground level and fresh weight of harvested produce in kilogram was recorded for each treatment separately and converted in to hectare basis by multiplying with multiple factors.

**Dry forage yield (q/ha)**
Thousand gram of green plant sample was weighed randomly from each net plot and kept in a brown paper bag. Then after, samples were sun-dried and then oven dried at 60 ºC till a constant weight was attained. After oven drying, the dry weight of sample was recorded and converted in to hectare basis by multiplying with multiple factors.

**Nitrogen content (%)**
The representative samples of stover for recording the dry forage yield were utilized for estimation of nitrogen content in stover. These samples of stover were powdered in a grinder having stainless steel blades to avoid contamination of micronutrients. Chemical analysis of stover samples for nitrogen content was determined on per cent dry weight basis as per method of modified Kjeldhal's as described by Jackson (1973) [7].

**Results and Discussion**
**Plant height**
An examination of data presented in above table-1 reveals that plant height recorded at 20, 40, 60 DAS and at harvest were found non-significant due to different sowing dates. However, numerically higher plant height was found by early sowing of forage crop which was 7.70, 4.03, 2.75 and 2.76 per cent higher over 30th November sowing at 20, 40, 60 DAS and at harvest, respectively. The maximum plant height in 15th October sowing might be due to timely sowing of sunflower which provides favourable climatic conditions in terms of temperature, humidity and bright sunshine hour during crop growth period have resulted in more cell division and enlargement which ultimately leads to more plant height. The minimum plant height observed in 30th November might be due to shortening the growth duration and reduction in the growth per day from sowing to harvest. Similar trend was also observed by Bainade *et al.* (1987) [3], Dar *et al.* (2014) [4] and Dasai (2014) [5]. The results of Dar *et al.* (2014) [4] showed that the highest plant height of fodder oat was recorded by early sowing than late sowing.
The plant height at different periodical growth stages were significantly affected by different row spacing treatments. Significantly taller plant was recorded by 30 cm row spacing but it was statistically at par with 45 cm row spacing at 20, 40, 60 DAS and at harvest. Significantly the lowest plant height was recorded by the 15 cm row spacing at 20, 40, 60 DAS and at harvest. The plant height in 30 cm row spacing was 11.13, 7.34, 5.66 and 12.54 per cent higher over 15 cm row spacing at 20, 40, 60 DAS and at harvest, respectively. Taller plant height in 30 cm row spacing might be due to competition between space, light, carbon dioxide, oxygen and humidity which forced the plants to grow vertically rather than horizontally. The present findings are in accordance with the findings of Nawaz *et al.* (2001) [12], Jahangir *et al.* (2006) [8] and Ahmed and Ahmed (2010) [1]. The results of Nawaz *et al.* (2001) [12] showed that the maximum plant height of sunflower crop was recorded at 30 cm row spacing.

**Days to 50 per cent flowering**
The data outlined in Table 1 indicates that the different sowing dates and row spacing did not exert their significant effect on days to 50% flowering of forage sunflower. However, more time is required for 50% flowering by delaying the sowing of sunflower. Lower number of days to 50% flowering was found at 45 cm row spacing. This might be due to the lesser inter row competition for light, nutrient and moisture and have adequate space to extend its leaf to intercept more light with less competition thus, resulted in reduced number of days for flowering. The present findings are in accordance with the findings of Mohamed (2013) [11]. They showed that the early days to 50% flowering of sunflower crop were recorded at wider row spacing as compared to narrow row spacing.

**Green forage yield (q/ha)**
Sowing the forage sunflower crop on 15th October produced numerical higher green forage yield which was to the tune of 13.15 per cent higher over of 30th November sowing at harvest. The higher green forage yield was due to timely sowing of sunflower which provides favorable climatic conditions in terms of temperature, humidity and bright sunshine hour during crop growth period have resulted in more cell division and enlargement which ultimately leads to more green forage yield.
Significantly the highest green forage yield was recorded by 30 cm row spacing. The percentage increased in green forage yield by the 30 cm row spacing was to the tune of 12.47 per cent than that of 15 cm row spacing. Higher green forage yield with 30 cm row spacing might be due to the higher values of plant height, number of leaves per plant, leaf length, leaf width, green leaf weight per plant, green stem weight per plant and green forage yield per plant. These findings are in close conformity with those reported by Dar *et al.* (2014) [4] and Mashreghi *et al.* (2014) [10]. The results of Dar *et al.* (2014) [4] reported that higher green fodder yield of baby corn was recorded by 50 x 15 cm crop geometry than that of 40 x 15 cm, 40 x 20 cm, 50 x 20 cm and 60 x 15 cm crop geometry.

**Dry forage yield (q/ha)**
Numerically higher dry forage yield of forage sunflower was obtained by 15th October sowing, which was to the tune of 11.31 per cent higher over of 30th November sowing at harvest. This might be due to higher green forage yield per hectare resulted in higher dry forage yield per hectare.
Significantly the highest dry forage yield was found at 30 cm row spacing. The percentage increased in dry forage yield by the 30 cm row spacing was to the tune of 13.04 per cent than

that of 15 cm row spacing. This might be due to higher green forage yield per hectare resulted in higher dry forage yield per hectare. These results are in accordance with the finding of Farnia and Mansouri (2014) [6], and Mashreghi *et al.* (2014) [10]. Farnia and Mansouri (2014) [6] showed that the highest dry forage yield of maize was recorded at 25 cm row spacing than 10 cm, 15 cm and 20 cm.

**Nitrogen content (%):** Data presented in Table 2 indicated that the effect of different sowing dates failed to exert their significant effect on nitrogen content. However, sowing of forage sunflower on 15th October gave numerically higher nitrogen content than delay sowing.

The effect of different row spacing on nitrogen content in forage sunflower was found to be non significant. However, 30 cm row spacing gave numerically higher nitrogen content as compared to other row spacing treatments.

**Table 1:** Plant height and days to 50% flowering of forage sunflower as influenced by sowing dates and row spacing

| Treatments | Plant height (cm) | | | | Days to 50% flowering |
|---|---|---|---|---|---|
| | 20 DAS | 40 DAS | 60 DAS | At harvest | |
| **Sowing dates (D)** | | | | | |
| $D_1$ : 15th October | 11.60 | 64.42 | 131.50 | 160.57 | 73.5 |
| $D_2$ : 1st November | 11.22 | 63.05 | 129.09 | 158.52 | 74.8 |
| $D_3$ : 15th November | 11.07 | 62.80 | 127.33 | 157.58 | 75.1 |
| $D_4$ : 30th November | 10.77 | 61.92 | 127.98 | 156.25 | 75.5 |
| S.Em. ± | 0.33 | 1.28 | 2.72 | 4.31 | 1.63 |
| C.D. at 5% | NS | NS | NS | NS | NS |
| C.V. % | 10.37 | 7.02 | 7.30 | 9.44 | 7.53 |
| **Row spacing(S)** | | | | | |
| **$S_1$ :** 15 cm | 10.51 | 60.30 | 124.78 | 146.38 | 76.4 |
| **$S_2$ :** 30 cm | 11.68 | 64.73 | 131.85 | 164.75 | 74.9 |
| **$S_3$ :** 45 cm | 11.31 | 64.11 | 130.30 | 163.56 | 72.9 |
| S.Em. ± | 0.27 | 0.96 | 2.01 | 3.21 | 1.40 |
| C.D. at 5% | 0.80 | 2.19 | 5.88 | 9.38 | NS |
| **Interaction (D x S)** | | | | | |
| S.Em. ± | 0.54 | 1.93 | 4.03 | 6.43 | 2.81 |
| C.D. at 5% | NS | NS | NS | NS | NS |
| C.V. % | 9.76 | 6.12 | 6.25 | 8.12 | 7.51 |

**Table 2:** Green forage yield, Dry forage yield and Nitrogen content in forage sunflower as influenced by sowing dates and row spacing

| Treatments | Green forage yield (q/ha) | Dry forage yield (q/ha) | Nitrogen content (%) |
|---|---|---|---|
| **Sowing dates (D)** | | | |
| $D_1$ : 15th October | 677.09 | 102.40 | 3.02 |
| $D_2$ : 1st November | 640.42 | 98.04 | 2.97 |
| $D_3$ : 15th November | 629.04 | 95.01 | 2.94 |
| $D_4$ : 30th November | 598.36 | 91.99 | 2.91 |
| S.Em. ± | 20.74 | 4.02 | 0.07 |
| C.D. at 5% | NS | NS | NS |
| C.V. % | 11.29 | 14.37 | 8.20 |
| **Row spacing (S)** | | | |
| $S_1$ : 15 cm | 600.25 | 91.51 | 2.90 |
| $S_2$ : 30 cm | 675.08 | 103.44 | 3.01 |
| $S_3$ : 45 cm | 633.35 | 95.63 | 2.97 |
| S.Em. ± | 13.34 | 2.83 | 0.06 |
| C.D. at 5% | 38.94 | 8.27 | NS |
| **Interaction (D x S)** | | | |
| S.Em. ± | 26.68 | 5.66 | 0.12 |
| C.D. at 5% | NS | NS | NS |
| C.V. % | 8.39 | 11.70 | 8.03 |

## References


1. Ahmed ME, Ahmed MF. Effect of irrigation intervals and inter- row spacing on the vegetative growth characteristics in sunflower (*Helianthus annuus* L.) hybrids in Shambat soil. Journal of Applied Sciences Research. 2010;6(9):1440-1445.
2. Anonymous. Food and Agricultural Organization, 2009.
3. Bainade SS, Raikhelkar SV, Shinde VS, Arthamwar DN. Effect of sowing date on growth and yield of forage maize in rabi season. Journal of Maharashtra Agricultural University. 1987;12(2):180-181.
4. Dar NA, Singh KN, Ahmad L, Sofi JA, Bhat ME, Kotru R. Influence of dates of sowing, cultivars and different fertility levels on fodder oat (*Avena sativa* L.) under temperate conditions of Kashmir valley (India). Range Mgmt. & Agroforestry. 2014;35(1):51-55.
5. Dasai. Effect of different sowing dates and planting geometry on growth, yield and quality of sweet sorghum [*Sorghum bicolor* (L.)] during winter season. M.Sc. (Agri.) Thesis (Published). NAU, Navsari, 2014.
6. Farnia, Mansouri. Effect of plant density to yield and yield components of maize (*Zea mays* L.) cultivars. Bulletin of Environment, Pharmacology and Life Sciences. 2014;3:123-127.

7. Jackson ML. Soil chemical analysis. Prentice-Hall of India Private Limited, New Delhi, India. 1973, 111-204.
8. Jahangir AA, Mondal RK, Nada K, Sadia AR, Hakim MA. Response of nitrogen and phosphorus fertilizer and plant spacing on growth and yield contributing character of sunflower. Bangladesh Journal of Scientific and Industrial Research. 2006;41(1-2):33-40.
9. Khaleghizadeh A. Effect of morphological traits of plant, head and seed of sunflower hybrids on house sparrow damage rate. Journal of Crop Protection. 2011;30(3):360-367.
10. Mashreghi M, Khorasani SK and Darban AR. Effect of planting methods and plant density on yield and yield component of fodder maize. Research Journal of Environmental and Earth Sciences. 2014;6(1):44-48.
11. Mohamed AM. Effect of seed size and plant spacing on vegetative growth and yield of sunflower (*Helianthus annuus* L.). Ph.D. (Agri.) Thesis (Published). University of Gezira, 2013.
12. Nawaz R, Ahemad R, Cheema Z, Mehmood T. Effect of row spacing and sorgaab on sunflower and its weeds. International Journal of Agriculture and Biology. 2001;3(4):360-362.