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Performance of sunflower (*Helianthus annuus* L.) hybrids under organic management conditions in mid hills of Sikkim

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ABSTRACT

A field study was carried out to evaluate the yield potential of six sunflower hybrids under organic management conditions at Research Farm, ICAR-National Organic Farming Research Institute, Tadong, Sikkim in the *Rabi* Season of 2016-17. The hybrids under study were KBSH-41, KBSH-44, KBSH-53, DRSH-1, DRSF-113 and LSFH-171. Among the hybrids significantly higher plant height was recorded in KBSH-41 (174.6 cm) and the lowest in KBSH-53 (132.4 cm). However, maximum capitulum diameter was observed in LSFH-171 (19.4 cm) and minimum in DRSF-113 (9.7 cm). The early maturing varieties were KBSH-44 and DRSF-113 (133 days). Among the hybrids significantly higher seed yield was observed in KBSH-41 (2.25 t/ha) over others but remained at par with DRSH-1 (1.97 t/ha). The oil content was highest in DRSH-1 (36.0%) followed by DRSF-113 (35.5%) and KBSH-41 (34.8%). However, maximum oil yield was recorded in KBSH-41 (0.78 t/ha) over other hybrids.

1. Introduction

Sunflower (*Helianthus annuus* L.) is one of the most important oilseed crops in the world, after soybean and rapeseed (Fernandez - Martinez *et al*., 2004) and suitable for year round cultivation due to its thermo sensitive nature (Babu *et al.,* 2016). Its seeds are used as food, medicinal purposes, dye making and its dried stalk is used as fuel (Fabian *et al*., 2014). Sunflower is increasingly cultivated in rice-based cropping systems for human consumption and for biodiesel (Okada *et al.*, 2008).

In India its area is gradually increasing under different soil and climatic conditions after the development of promising hybrid varieties from various parts of country. In India, during 2014-15 it was cultivated in 0.59 million hectare area with a production of 0.43 million tonnes and 736 kg/ha productivity. In Sikkim, among the oilseed crops cultivated in the state, rapeseed and mustard occupy prime portion (Singh *et al*., 2012).

In the state, 64% deficit in oilseeds is observed due to low production and productivity of rapeseed and mustard. It is, therefore, necessary to identify some other potential crop to maximize production and

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reduce the gap between demand and supply in oilseeds in the state. Sunflower has high yield potential and oil content as compared to mustard and rapeseed; and hence, it can play an important role in meeting the shortage in oilseeds in the region (Babu *et al.,* 2015).

Sikkim is a leading state in organic farming and further showing the way to organic agriculture. Screening of high yielding varieties, especially hybrids of sunflower through multi-locational testing with certain key characters desirable for organic farming includes good establishment ability, better performance under low input condition and persistent robust yield. The need for introducing new oilseeds crops is necessary to expand the area and production in Sikkim to meet the rising demand for the oilseeds. Considering these facts and figures in the field of sunflower varieties' interaction with different soils and climatic conditions of Sikkim, the implementation and execution of this kind of examination seems to be essential. Hence, it is necessary to evaluate the available hybrid varieties on their growth, development and seed and oil yield potential. Hence, the present study was carried out with an objective to identify the suitable sunflower hybrid varieties with regard to yield potential under organic management conditions in the mountain agriculture of Sikkim.

2. Material and Methods

The field study was carried out in *Rabi* Season of 2016-17 to evaluate the seed yield potentials of six sunflower hybrids at the Research Farm of ICAR-National Organic Farming Research Institute, Sikkim located at 1300 meters amsl with latitude 27° 33' N and longitude 88° 62' E. The climate of the area is mid hill temperate. During the cropping period total 482.1 mm rainfall was received and maximum mean temperature of 22.6ºC was observed in May and minimum (11.3°C) in December (Fig.1). The soil of experimental field was clay loam with pH 5.8 (1: 2.5 soil and water ratio), 225.5 kg/ha alkaline permanganate oxidizable N, 25.10 kg/ha Brays P_1, 196.3 kg 1 *N* ammonium acetate exchangeable K and 1.63% organic carbon. Six sunflower hybrid varieties *viz*., KBSH-41, KBSH-44, KBSH-53, DRSH-1, DRSF-113 and LSFH-171 were evaluated for their growth and yield potential. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The crop was grown according to the package of practices recommended for the region (Babu *et. al.*, 2015). The crop was planted at a spacing of 50 cm × 30 cm on December 5, 2016. The recommended dose of nitrogen (@ 80 kg/ha) was applied through different combinations of farmyard manure, mix compost and vermicompost. Different parameters *viz.,* plant height (cm), days to maturity, capitulum diameter (cm), test weight (g) and seed yield (t/ha) were taken and analyzed. The 1000-seed were taken in account for test weight. Oil content of each genotype was analyzed using a bench top pulse nuclear magnetic resonance (NMR)-MQC-5 analyzer (Oxford, London), supplied with preloaded 'easy cal' software, calibrated with known oil sunflower seed sample. The calibration was performed with 40 mm diameter sample probe, 5 MHz operating frequency, 4 scans, 1 s recycle delay and 40.00 magnetic box temperature. NMR room temperature was maintained at 25ºC +/-2. Before construction of calibration sample, seeds were dried at 80°C for 8 hours in a hot air oven. Oil yield was calculated as a function of seed yield and oil percentage with the following formula (Singh *et al*., 2003).

Oil yield (t/ha) = Oil content (%)/100 × seed yield (t/ha)

All the data obtained was statistically analysed using the *F*-following Gomez and Gomez (1984). LSD values at $P = 0.05$ were used to determine the significance of difference between treatment means.

3. Results and Discussion

It is revealed from the data that plant height, days to maturity, capitulum diameter, test weight and seed yield indicated significant differences among the hybrids (Table 1). Among the varieties significantly higher plant height was recorded in KBSH-41 (174.6 cm) over rest of the hybrids. The plant height of KBSH-44 (164.7 cm) was also significantly higher than all other varieties

except KBSH-41. The lowest plant height was observed in KBSH-53 (132.4 cm). Since dwarf plant height is a desirable characteristic (Gvozdenovic *et al*., 2005) for sunflower to avoid lodging, KBSH-53 (132.4 cm) and DRSH-1(134.9 cm) are promising in this respect. The capitulum diameter was also affected significantly and the biggest diameter was recorded in LFSH-171 (19.4 cm) followed by KBSH-44 (18.8) and KBSH-41 (18.6 cm). The smallest capitulum was recorded in DRSF-113 (9.7 cm). Similarly, the test weight was also significantly higher in LFSH-171 (78.4
g) over KBSH-53, KBSH-44 and KBSH-41 but remained at par with DRSH-1 and DRSF-113. Maturity duration also differed significantly and the lowest duration was taken by the KBSH-44 (133 days) and DRSF-113 (133 days); whereas, maximum duration was taken by KBSH-53 for maturity. The seed yield was also significantly affected and the highest yield was observed in KBSH-41 (2.25 t/ha) over all other hybrids. The increase in seed yield in KBSH-41 was in the tune of 33.8, 32.4, 20.9, 18.2 and 12.4 percent higher than KBSH-44, KBSH-53, DRSF-113, LFSH-171 and DRSH-1, respectively.

Table 1. Yield attributes yield of different sunflower hybrids

Variety/ Hybrid	Plant height (cm)	Days to Maturity	Capitulum diameter (cm)	Test weight (g)	Seed yield (t/ha)	Oil content (%)	Oil yield (t/ha)
KBSH -41	174.6	138.0	18.6	70.1	2.25	34.8	0.78
KBSH-44	164.7	133.0	18.8	65.2	1.49	28.4	0.42
KBSH-53	132.4	137.0	12.2	58.2	1.52	33.2	0.51
DRSH-1	134.9	134.0	15.5	76.3	1.97	36.0	0.71
DRSF-113	157.3	133.0	9.7	77.1	1.78	35.5	0.63
LSFH-171	145.8	135.0	19.4	78.4	1.84	30.8	0.57
SEm±	2.7	1.2	0.6	1.1	0.01	--	--
LSD (*P*=0.05)	8.5	3.9	2.0	3.4	0.03	--	--

Variation in the different parameters among the varieties may be due to varietal and genetic difference. The increase in yield in KBSH-41 might be due to more synchronization of transportation of photosynthates from the source to sink as compared to other varieties. The KBSH-41 takes longer duration for its maturity also which helps for accumulation of higher dry matter for resulting in seed yield. The test findings are differing with the earlier reports given by Nichal *et al.* (2016) Similar results observed by Shanwad *et al.* (2016) and Baramaki *et al*. (2009) revealed that the yield and yield components of sunflower differed due to the performance of different sunflower hybrids in response to weather and management practices. The oil content (%) was affected by the different hybrids and varied from 28.4% to 36.0%. The highest oil content was recorded in DRSH-1 (36.0%) followed by DRSF-113 (35.5%) and KBSH-41(34.8%) while lowest in KBSH-44(28.4%) (Table 1). Varied oil content is the genetic characteristics of different hybrids which might be due to the environment. Similar results of oil content were also reported by Yadav *et al.* (2016). In contrast to the oil percent, oil yield was higher in KBSH-41 (0.78 t/ha) followed by DRSH-1 (0.71 t/ha). The higher oil yield in KBSH-41 was due to higher seed yield than other hybrids.

Conclusion

Sunflower being a nutrient exhaustive crop, the hybrids respond to both nutrients and water. Hence, the farming community should be careful in the selection of hybrids for their cultivation. The present study produced some guidelines for the farmers of the area based on their objective in selection of a particular hybrid variety. The study recommends the promising hybrid varieties KBSH-41, DRSH-1 and LSFH-171 to the farmers for higher oilseed yield in the mid hills of Sikkim.

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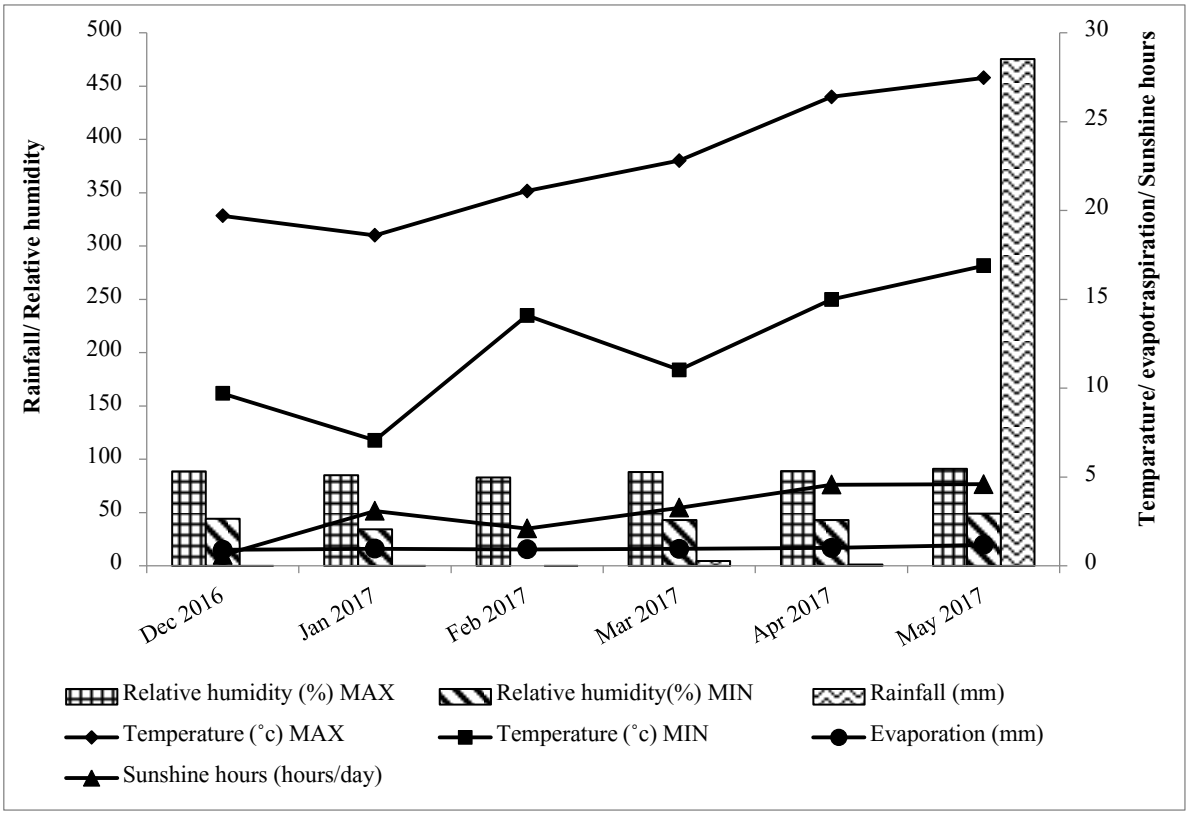

Figure 1. Metrological data during experimental period

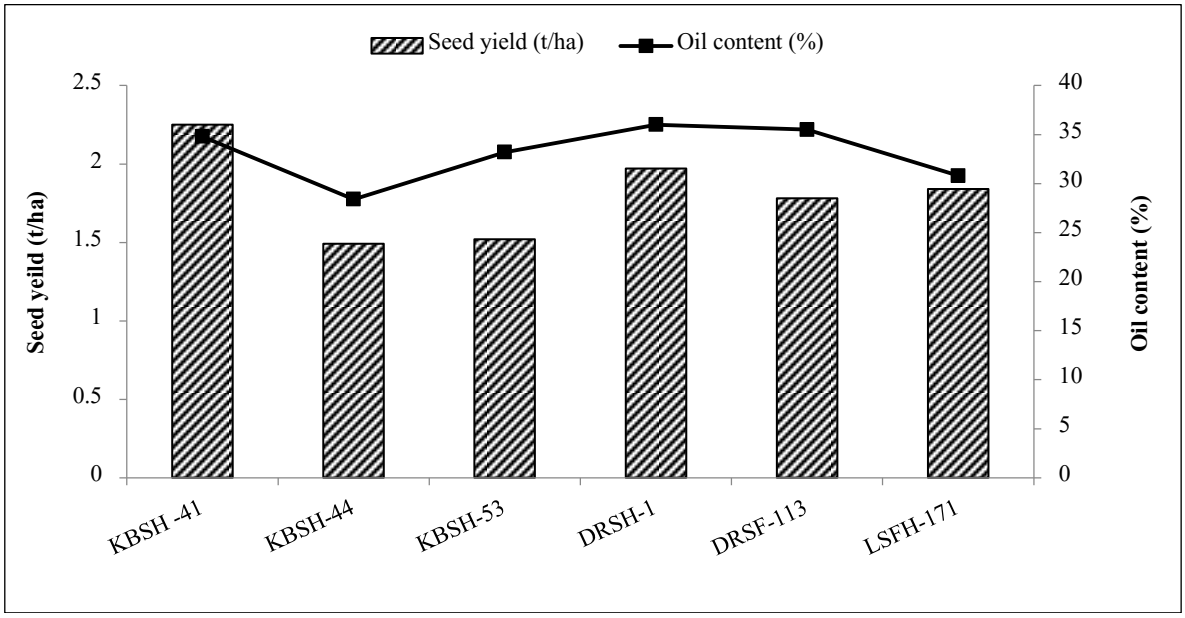

Figure 2. Seed yield and oil content of the sunflower varieties

References

Babu S, Singh R, Avasthe RK, Yadav GS and TK Chettri (2015). Sunflower (*Helianthus annuus*) - A promising oil seed crop for mid hill ecosystems of Sikkim Himalayas. Popular Kheti 3(4): 30-34

Babu Subhash, Rana DS, Yadav G S and Singh Raghavendra. 2016. Influence of sunflower stover and nutrient management on growth, yield and energetics of sunflower (Helianthus annuus) in a pigeonpea (Cajanus cajan)- sunflower cropping system. Indian Journal of Agricultural Sciences86 (3): 315–20

Baramaki E, Jalili F, Eyvazi A, and A Rezaei (2009). Fe, Zn and B foliar spray on yield and quality of two sunflower cultivars. Journal of Research Agriculture Science 26(6): 2-13

Fabian FL, Fernando LV, Mariana MA, Minerva RM, Nicolaza P, and EZ Roberto (2014). An introduction to the sunflower crop. In: IA Juan (ed) Sunflowers, Nova Science Publishers, Inc. pp. 19

Fernandez-Martinez J, Velasco L, and B Perez-Vich (2004). Progress in the genetic modification of sunflower oil quality. Proc. of 16th International Sunflower Conference, Fargo, ND USA, 1-14

Gomez KA and AA Gomaz (1984). Statistical procedures for Agricultural Research. John Wiley & Sons, Singapore.

Gvozdenovic S, Joksimovic J, and D Skoric (2005). Gene effect and combining abilities for plant height and head diameter in sunflower. Genetica 37(1): 57-64

Nichal SS, Chawhan RG, Tayade SD, and RD Ratnaparkhi (2016). Correlation of seed and seedling characters with seed yield of sunflower hybrids. PKV Res J 40(1): 1-4

Okada K, Matsuzaki M, Yasumoto S, Iijima W, and TT Ktaniwaki (2008). Production and utilization of rapeseed and sunflower for the purposes of bio-energy and revitalization of rural communities. Journal of Crop Research 53: 85-90

Shanwad UK, Shankergoud I, Sudhakarbabu SN, Vinod Kumar W, Kanatti A, and V Kulkarni (2016). Performance of sunflower hybrids in black cotton soils of northern Karnataka, India. 19th International Sunflower Conference, Edirne, Turkey, 2016, pp. 896-904

Singh Raghavendra, Babu S, Kalita H, Gopi R, Kapoor C, and SK Das (2012). *Brassica* spp. (Rapeseed and Mustard). In: R Avasthe, Y Pradhan, K Bhutia (eds) Handbook of organic crop production in Sikkim, Published by Sikkim Organic Mission, Govt. of Sikkim, India in collaboration with ICAR Research Complex for NEH Region, Sikkim Center (ICAR-NOFRI), Tadong, Gangtok, Sikkim, pp. 39-45

Singh Raghavendra, Sen Avijit, Sharma SN and RK Singh (2003). Effect of plant spacing on growth, yield and seed quality in inbred lines of sunflower hybrids. Indian Journal of Plant Physiology 8 (4): 364-368

Yadav P, and IYLN Murthy (2016). Calibration of NMR spectroscopy for accurate estimation of oil content in sunflower, safflower and castor seeds. Current Science 110(1): 73- 76