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RESEARCH ARTICLE :

Effect of different levels of fertilizer doses on oil content, protein and oil yield of sunflower cultivars

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SUMMARY : A field experiment was carried out on effect of fertilizer doses on growth, oil content and oil yield of sunflower cultivars in *Kharif* season at Oilseed Research Station, Latur. The experiment was laid in split plot design with three replications consisting of four fertilizer doses (0, 50, 100 and 150 % RDF) and five sunflower cultivars (DRSF-108, LSF-08, DRSH-01, LSFH-35 and Jwalamukhi). The results of field study indicated that the oil content and oil yield of sunflower were significantly influenced by fertilizer doses and cultivars. Application of 100% RDF (60:30:30 NPK kg ha^{-1}) significantly improved oil content and oil yield of sunflower followed by 90:45:45 kg ha^{-1}. Among the different cultivars of sunflower DRSH-01 was found superior in oil content and oil yield of sunflower followed by Jwalamukhi, DRSF-108, LSF-08 and LSFH-35. With regards to sunflower cultivars,the oil yield was increased by 49 and 46 per cent due to DRSH-01 and Jwalamukhi, respectively over local check (LSF-08). The data further indicated that interaction effect on oil yield (684 kg ha^{-1}) was highest due to C_3 (DRSH-01) x F_3 (150% RDF) treatment but it was at par with C_3 x F_2 (100% RDF). The reatment F_2 (100% RDF) was significantly superior over rest of the treatments in case of protein content (16.99%) and pritein yield in seed. The cultivar DRSH-01 recorded significantly higher protein content (17.6%) over rest of the treatments.

KEY WORDS :
Sunflower cultivars, Fertilizer dosses, Oil content, Protein content, Oil yield, Protein yield

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BACKGROUND AND OBJECTIVES

Sunflower (*Helianthus annuusL.)* is one of the most important oilseed crop of the world. In India sunflower is grown over an area of 23.5 lakh hectares with a production of 14.88 lakh tonnes due to favorable monsoon in major sunflower growing regions. In Maharashtra sunflower is grown on an area of 3.37 lakh hectares with the production of 1.75 lakh million tones and having productivity 520 kg ha^{-1} (Anonymous, 2008). Sunflower contains oil upto 52% and about 14-19 % protein and 30-35 % carbohydrates. In recent years sunflower gained importance due to its wider adaptability and rich source of polysaturated fatty acids.

Sunflower crop production is complex process controlled by a large number of exogenous and endogenous factors. The endogenous factors like mineral nutrition is

very important factor that affect the crop production specially due to nutrients like N, P, and K. Therefore, for wide spread adoption and exploitation of high yield potential of the sunflower hybrids, it is important to work out requirement of graded levels of fertilizer under rained condition of Marathwada.

RESOURCES AND METHODS

An experiment was conducted on effect of different levels of fertilizer doses on protein and oil yield of sunflower cultivars. The experimental soil was deep black with clay in texture, moderately calcareous in nature and slightly alkaline in reaction. It was low in available N, moderately high in available P, moderately high in available K and high in available S content of the soil.

The experiment was laid in Split Plot Design with three replications consisting of four fertilizer doses (0, 50, 100 and 150 % RDF) and five sunflower cultivars (DRSF-108, LSF-08, DRSH-01, LSFH-35 and Jwalamukhi). Oil content in seed was estimated by Soxhlet extraction method and oil percentage in seed was calculated with the formula as given below.

$$\text{Oil percentage} = \frac{\text{Weight of oil (g)}}{\text{Weight of seed sample (g)}} \times 100$$

By using oil percentage in sunflower seed, oil yield kg ha^{-1} was calculated as given below

$$\text{Oil yield (kg ha}^{-1}\text{)} = \frac{\text{Grain yield (kg ha}^{-1}\text{) x Oil percentage}}{100}$$

OBSERVATIONS AND ANALYSIS

The present investigation was undertaken to study the effect of different levels of fertilizer doses on oil content, oil yield and protein yield of sunflower cultivars. The results obtained were statistically analyzed, interpreted and presented accordingly.

Oil content and oil yield :

The data on oil content and oil yield are presented in Table 1. The oil content and oil yield of sunflower were significantly influenced due to different levels of fertilizer and cultivars. It is evident from result that the treatment F_2 (100%RDF) recorded maximum oil content (39.05%) as compared to rest of the treatments. The treatment F_2 recorded significantly higher oil content over rest of the treatments except

F_3 (150% RDF).The treatment F_2 and F_3 are at par with each other. Significantly higher oil yield (548 kg ha^{-1}) was recorded with treatment F_2 (100% RDF) over rest of the treatments but it was at par with the treatment F_3 (150% RDF).Lower oil yield (359 kg ha^{-1}) was recorded in control plot. Among the cultivar DRSH-01 recorded maximum oil content (39.11%) and oil yield (579 kg ha^{-1}) which was significantly superior over DRSF-108, LSF-08, and LSFH-35 but at par with cultivar Jwalamukhi.The data in Table 1 further revealed that the treatment F_2 (100% RDF) recorded 34% increase in oil yield over control, while treatment F_3 (150% RDF) and F_1 (50% RDF) recorded 31 and 13 per cent increase in oil yield over control, respectively. With regards to cultivars higher per cent increase in oil yield of 49 and 46 per cent was observed due to DRSH-01 and Jwalamukhi, respectively. Interaction effect between fertilizer levels and cultivars on oil yield was found to be also significant (Table 2).

Table 1 : Oil content (%) and oil yield (kg ha^{-1}) as influenced by various treatments

Treatments	Oil content (%)	Oil yield (kg ha^{-1})	% increase over control
Fertilizer levels (F)			
F_0 – (Control)	35.90	359	-
F_1 – 50% RDF	36.61	412	13
F_2 – 100% RDF	39.05	548	34
F_3 – 150 % RDF	38.48	524	31
S.E. ±	0.22	2	-
C.D. (P=0.05)	0.65	6	-
Cultivar (C)			
C_1 : DRSF – 108	36.21	389	24
C_2 : LSF – 08	35.95	297	-
C_3 : DRSH – 01	39.11	579	49
C_4 : LSFH – 35	37.36	478	38
C_5 : Jwalamukhi	37.66	548	46
S.E. ±	0.53	7	-
C.D. (P=0.05)	1.60	21	-
Interaction (F×C)			
S.E. ±	1.06	14	-
C.D. (P=0.05)	NS	43	-
General Mean	37	460	

The treatment combination C_3 (DRSH-01) x F_2 (100% RDF) recorded significantly higher oil yield (658 kg ha^{-1}) over rest of the treatments except C_3 x F_3. Lower oil yield was recorded with the treatment combination C_2 (LSF-08) x F_1 (50% RDF).

Thorat *et al.* (2005) observed that the oil content

Table 2 : Interaction effect of fertilizer levels and cultivars on oil yield (kg ha^{-1}) of sunflower

Fertilizer levels and cultivars	F_0 (control)	F_1 (50%RDF)	F_2 (100% RDF)	F_3 (150% RDF)	General mean
C_1 - DRSF-108	352	328	470	404	389
C_2 - LSF-08	232	217	388	326	297
C_3 - DRSH-01	373	539	658	684	579
C_4 - LSFH-35	478	435	413	505	478
C_5 – Jwalamukhi	415	539	603	638	548
S.E. ±	14	-	-	-	-
C.D. (P=0.05)	43	-	-	-	-
General mean	359	412	548	524	460

was increased due to application of 60 kg P_2O_5 ha^{-1}. This might be due to the fact that P helped in synthesis of fatty acids and their esterification by accelerating biochemical reactions in glyoxalate cycle. Similar findings were also recorded by Parameshwarappa and Salimath (2007), Nandhagopal *et al.* (1995) and Sathiyavelu *et al.* (1994).

On the other hand Bahl *et al.* (1997) reported that phosphorus application upto 30 kg P_2O_5 ha^{-1} resulted in a significant increase in the oil content at all the levels of N. However N application decreased while P application increased the oil content.

Protein content and protein yield :

The results regarding protein content and protein yield are presented in Table 3. The protein content and protein yield of sunflower were significantly influenced by various fertilizer levels and cultivars. The data indicated that the treatment F_2 (100% RDF) was significantly superior over rest of the treatments in case of protein content in seed (16.99%). Significant differences in protein content were observed among the cultivars. The cultivar DRSH-01 recorded significantly higher protein content (17.6%) over rest of the treatments. With respect to protein yield the treatment F_2 (100% RDF) was significantly superior over F_0 (control) and F_1 (30:15:15 kg ha^{-1}) but it was at par with F_2 (90:45:45 Kg ha^{-1}). Cultivar DRSH-1 recorded higher protein yield (260.4 kg ha^{-1}) which was significantly superior over all other cultivars except Jwalamukhi. Both protein content and protein yield was found lower in F_0 (control) and cultivar LSF-08.Interaction effect on protein yield due to fertilizer levels and cultivars were not significantly.

According to Bahl *et al.* (1997) in sunflower oil content was increased with applied P But, on N application in the absence of P, decreased oil content. An inverse relationship was observed between crude protein content and per cent oil due to application of nitrogen without P. The possible reason may be the degradation of carbohydrates in TCA (Tricarboxylic acid) cycle due to application of N which are further degraded to acetyl coA and thus there would be more protein in plant cells with increasing supply of nitrogen. Simultaneously, as the percentage of oil decreases, a very low amount of acetyl co A available for synthesis of fatty acids.

Similarly Thorat *et al.* (2005) and Sabale (2003) observed that highest protein content was found with

Table 3 : Protein content (%) and Protein yield (kg/ha) as influenced by various treatments

Treatments	Protein content (%)	Protein yield (kg ha^{-1})
Fertilizer levels (F)		
F_0-Control(0%RDF)	15.41	154
F_1-50%RDF	16.12	181
F_2-100%RDF	16.99	239
F_3-150%RDF	16.33	222
S.E.±	0.195	10
C.D. (P=0.05)	0.539	28
Cultivar (C)		
C_1:DRSF-108	15.51	167
C_2:LSF-08	14.84	122
C_3:DRSH-01	17.60	260
C_4:LSFH-35	16.14	206
C_5:Jwalamukhi	16.97	247
S.E.±	0.056	13
C.D. (P=0.05)	0.157	36
Interaction (FxC)		
S.E.±	0.113	26
C.D. (P=0.05)	NS	NS
General mean	16.21	512

NS=Non-significant

application of 60 kg P_2O_5 ha^{-1} effect of phosphorus levels on protein yield was found to be significant. This might be due to the enhanced availability of P, which increased the levels phosphorus containing coenzymes, which involved in the synthesis of fatty acids.

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