The effect of different amounts of animal manure on qualitative and quantitative traits of sunflower hybrid varieties

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ABSTRACT

A field study was conducted to investigate the effect of different amounts of animal manure on quantitative and qualitative traits of sunflower hybrid varieties in 2006-2007 at the Uromia Agricultural Research Station, Iran. The experimental design was a completely randomized block with three replications. The first factor was animal manure at 0, 15, 30 and 45 t ha^{-1} and the second factor was 3 hybrid varieties: Euroflir, Alistar and Golshid. The parameters assessed were head diameter, stem diameter, number of seeds per head, 100 seed weight, oil percentage, protein percentage, harvest index, seed yield, biomass and oil yield. Results of this study showed significant effects of different amounts of animal manure and various varieties on head diameter, number of seeds per head, 100 seed weight, seed yield, and oil yield. Comparison of mean data showed that by increasing rate of manure, the head and stem diameter, number of seeds per head, 100 seed weight, seed yield, biomass and oil yield were increased. The results revealed that the Golshid variety had the highest values for all the traits, except oil percentage and harvest index. Correlation analysis showed that seed yield had a significant positive correlation with head diameter, stem diameter, plant height, number of seeds per head, 100-seed weight, protein percentage, biomass and oil yield. According to these results, application of 45 t ha^{-1} animal manure increases the quantitative and qualitative yield of sunflower. Golshid variety was found to be suitable for cultivation in the region.

Key words: animal manure – hybrid varieties – oil yield – seed yield – sunflower.

INTRODUCTION

Sunflower has modest fertility needs, but does respond to animal manure. When following soybeans in the rotation, roughly 30 to 50 t of animal manure per ha are appropriate. Following a non-legume, about 80 to 100 t of animal manure per ha is suitable. Animal manure or a legume cover crop can reduce or eliminate need for N fertilizer (Khajehpour, 1998).

Sunflower (*Helianthus annuus* L.) has relatively proved to be a good oil seed crop in Iran. It is a potential source of high quality edible oil. Due to the increasing edible use of this oil crop, its production has been enhanced rapidly all over the world. Sunflower seed contains 48-52% of good quality edible oil and 40-50% of protein in the meal (Khajehpour, 1998). The oil cake from sunflower is also useful for cow and fish feeding. At present, sunflower is grown in many districts of Iran without proper care. The total cultivation area of this oil crop is limited. The progress in sunflower production has been slow due to the lack of proper production technologies and management practices. Among the several agro-techniques which can enhance the production of yield is the use of proper land preparation, irrigation, fertilizer application, proper plant spacing and other important related factors. So, an attempt has been made to study the effect of animal manure for obtaining a maximum yield of sunflower.

MATERIALS AND METHODS

The experiment was conducted in the experimental field of Uromia Agricultural Research Station, Iran in 2005. The soil of the experimental site was loamy, pH of 8.5, 0.9% organic matter and 0.09% total nitrogen. The unit plot size was 3 by 5 m. The varieties used for the study were 3 hybrid varieties: Euroflir, Alistar and Golshid. The experiment was carried out in a randomized block design with three replications. The row spacing was 60 m. The plant spacing was 25cm. With regard to the results of the animal manure analyses under study, the concentrations of total N, P and K were 1.54, 0.75 and 2.8% respectively. At the time of land preparation, animal manure was incorporated into the soil. At harvest time, 10 plants were selected randomly from each plot and plant height and different yield contributing characters (Table 1) were measured. Grain protein content was also determined by a grain analyzer. The data were analyzed using the SAS statistical package (SAS Institute, 1996) and the mean comparisons

were made following Duncan's multiple range test at P = 0.05 by MSTATC (version 2.10, Inc, Michigan State University). The correlation coefficients between all pairs of traits were determined by the SPSS statistical package (version 10, Chicago, USA).

RESULTS AND DISCUSSION

The data on the effect of the animal manure and the cultivar and their interaction are presented in Table 1. By increasing the rate of animal manure, the head diameter was increased. The maximum head diameter was obtained from 30 t ha^{-1} treated plots. Comparison of different cultivars showed that Golshid cultivar had the highest head diameter at any of the animal manure levels. This result is consistent with previous reports that plant growth, photosynthesis and nutrient uptake are affected (increased) under animal manure treatments (Kandil et al., 1988). Animal manure had also a significant effect ($p \leq 0.05$) on stem diameter, number of seeds per head, 100 seed weight, seed yield, biomass, and oil yield of all cultivars (Table 1). The response of the cultivars differed significantly with increasing animal manure levels ($p \leq 0.05$). Golshid cultivar had the highest value of the above measured parameters at all animal manure rates.

Table 1. Analysis of variance to test the effect of animal manure on yield and yield contributing traits of sunflower[1]

Source	d.f.	Head Ø	Stem Ø	Plant height	Number of seeds per head	100 seed weight	Seed yield	Bio-mass	Harvest index	Oil content	Protein content	Oil yield
Replication	2	ns	ns	ns	**	ns	ns	ns	ns	ns	ns	*
Animal manure	3	**	*	ns	**	**	**	**	ns	ns	ns	**
Cultivar	2	**	**	**	**	**	**	**	**	ns	**	**
Animal manure x cultivar	6	ns	ns	ns	ns	ns	ns	*	ns	ns	ns	*

[1]ns, not significant; *, ** Significant at 0. 05 and 0. 01 probability levels, respectively.

With increasing of animal manure levels, the sunflower stem diameter increased, which may be due to increasing nutrient uptake and translocation and increasing of photosynthesis (Hassanzadeh-Gorttapeh et al., 2006).

In crop production, the most important part is the plant's reproductive stage. If photoassimilates are allocated at a suitable time, the number of filled seed per head increases. Although the important yield components are seed weight and number of seeds per head, heads with a large diameter accompanied by more seeds could result in giving a higher yield (Vannozzi et al., 1987).

The maximum number of seeds per head was found by application of animal manure at 45 t/ha. The results were in close conformity with those of Steer et al. (1984). In general, the application of animal manure improved the yield components of sunflower. The plots treated with 45 t/ha animal manure produced the highest 100 seed weight. The results are in close agreement with the findings of Hassanzadeh-Gorttapeh et al. (2006).

According to the results of this study, we can conclude that the application of animal manure can reduce the input consumption per unit area. Among the cultivars studied, Golshid cultivar gave the highest yield due to its higher head weight, number of seeds per head and 100 seed weight. No significant difference in the oil content among the cultivars studied was observed. Therefore, Gholshid cultivar is suitable and may be recommended for this region. The results are in close agreement with the findings of Ulger et al. (1993) and Singh et al. (1996).

Correlation coefficients between traits are presented in Table 2. As reflected in the literature, the number of seeds per head is the yield component most significantly correlated with grain and oil yield (Connor et al., 1997; López-Pereira et al., 1999; Steer et al., 1984). Moreover, the stronger correlation between grain yield with oil yield, compared with that between oil percentage and oil yield, shows that ultimately higher grain yields will mean higher oil yield for farmers. The highly positive correlation ($r=0.87^{**}$) between grain yield and plant height (Table 2) suggest that the seed yield is positively influenced by biomass, in addition to the number of seeds per head (Kesteloot, 1982; Lakshmanrao, 1985).

Table 2. Correlation coefficients between sunflower traits under treatment with different doses of animal manure[1]

	Head Ø	Stem Ø	Plant height	Number of seeds per head	100 seed weight	Seed yield	Bio-mass	Harvest index	Oil content	Protein content
Oil yield	0.78**	0.81**	0.81**	0.94**	0.83**	0.97**	0.92**	0.72**	0.27 ns	0.40*
Protein content	-0.38*	0.52**	0.46**	0.20ns	0.75**	0.50**	0. 53**	-0.55**	-0.55**	
Oil content	-0.45**	-0.48**	-0.39**	-0.31ns	-0.60**	-0.48**	-0.49**	0.40*		
Harvest index	-0.81**	-0.89**	-0.89**	0.61**	0.76**	0.55**-	-0.88**			
Biomass	0.48**	0.91**	0.89**	0.85**	0.89**	0.96**				
Seed yield	0.81**	0.85**	0.83**	0.92**	0.90**					
100 seed weight	0.77**	0.84**	0.79**	0.69**						
Number of seeds per head	0.78 **	0.77**	0.77**							
Plant height	0.88 **	0.96**								
Stem diameter	0.96 **									

[1]ns, not significant; *, ** Significant at 0. 05 and 0. 01 probability levels, respectively.

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