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# ASSOCIATION PATTERN AMONG THE YIELD ATTRIBUTES IN VARIETIES AND HYBRIDS OF SUNFLOWER (*Helianthus annuus* L.)

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SUMMARY

Three varieties, CO 4, Morden and TNHSF 239 (a pre-release culture) and two hybrids, TCSH 1 and KBSH 44, were selected for this study. Simple correlation coefficients were estimated among characters for individual varieties and hybrids. Two traits, seed yield and 100-seed weight, are important selection indices for oil yield improvement in both varieties and hybrids. Head weight can be considered as a selection index for improvement of seed and oil yield in hybrids only. Likewise, oil content is an important selection index for oil yield improvement in varieties. It can also be inferred that the results obtained from the association analysis of pooled data for varieties and hybrids will give ambiguous results and have a negative impact on the yield improvement program. Thus it is desirable to compute separate association analyses for each variety and hybrid to identify effective selection indices for the improvement of sunflower.

**Key words: sunflower, correlation, varieties and hybrids, selection index**

## INTRODUCTION

Yield is a complex character which is influenced by other yield component characters. The knowledge on the association of several characters with yield and interrelationships among these characters is essential for planning a successful plant breeding program. The nature of association varies depending on the genetic architecture of population under study. Sunflower hybrids differ from varieties due to their heterotic potential. Hence the association among characters may vary for varieties and hybrids. However, the importance of this fact has not received due attention. An attempt was made in the present study to gain knowledge of the association

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between oil yield and its component characters in three sunflower varieties and two hybrids.

## MATERIALS AND METHODS

Three varieties, CO 4, Morden and TNHSF 239 (a pre-release culture), and two hybrids, TCSH 1 and KBSH 44, were selected for study. All the genotypes were evaluated at Oilseeds Farm, Tamil Nadu Agricultural University, Coimbatore, during rabi/summer 2004-05. A total of 50 plants per genotype were subjected to nine biometrical observations: plant height (cm), head diameter (cm), stem girth (cm), head weight (g/plant), 100-seed weight (g), volume weight (g/100 ml), oil content (%), seed yield (g/plant) and oil yield (g/plant). Simple correlation coefficients were calculated among the characters for each variety and hybrid separately.

## RESULTS AND DISCUSSION

Simple correlation coefficients were presented in Table 1.

**Oil yield *vs* other characters**

Oil yield had significant positive correlations with seed yield and 100-seed weight in both varieties and hybrids. This indicated that seed yield and 100-seed weight exhibit highly effects on oil yield in both varieties and hybrids. Hence these two characters are important for oil yield improvement. Djakov (1966), Škorić (1975), and Ghanavathi and Nahavandi (1981), Vannozzi *et al.* (1986) and Mogali (1993) also reported significant association of oil yield with seed yield. Abdel *et al.* (1987) reported that both seed yield and 100-seed weight were significantly and positively associated with oil yield.

Oil content had a significant and positive association with oil yield only in the varieties. Similarly, head weight had a significantly positive association with oil yield in the hybrids only. This type of association might be due to the presence of higher source and sink capacities in hybrids and hybrid vigor when compared with varieties. The effect of oil content might have been masked by another component character namely the seed yield in respect of hybrids. Likewise, the hybrid vigor might have been expressed for head weight and in turn it might have influenced the oil yield in hybrids. Djakov (1966), Škorić (1975) and Ghanavathi and Nahavandi (1981) reported a positive association between oil yield and oil content. Although the characters head weight, stem girth and volume weight significantly affect oil yield in some varieties and hybrids; no specific association trend could be observed for the hybrids and varieties in our study. However, Ghanavathi and Nahavandi (1981) and Vannozzi *et al.* (1986) for head diameter and Vannozzi *et al.* (1986) and Abdel *et al.* (1987) for plant height reported positive associations of these characters with oil yield.

Table 1: Simple correlation coefficients among various characters in hybrids and varieties

| Character | Genotype | Plant height (cm) | Head diameter (cm) | Stem girth (cm) | Head weight (g) | 100-seed weight (g) | Volume weight / 100 ml (g) | Oil content (%) | Seed yield/ Plant (g) |
|---|---|---|---|---|---|---|---|---|---|
| Head diameter (cm) | CO 4 | 0.03 | | | | | | | |
| | Morden | 0.58** | | | | | | | |
| | TNHSF 239 | 0.16 | | | | | | | |
| | TCSH 1 | -0.15 | | | | | | | |
| | KBSH 44 | -0.13 | | | | | | | |
| Stem girth (cm) | CO 4 | 0.00 | -0.02 | | | | | | |
| | Morden | -0.11 | -0.23 | | | | | | |
| | TNHSF 239 | 0.05 | -0.12 | | | | | | |
| | TCSH 1 | -0.29* | 0.21 | | | | | | |
| | KBSH 44 | 0.19 | -0.26 | | | | | | |
| Head weight (g) | CO 4 | 0.12 | 0.05 | -0.26 | | | | | |
| | Morden | 0.11 | 0.25 | -0.02 | | | | | |
| | TNHSF 239 | -0.09 | -0.26 | 0.07 | | | | | |
| | TCSH 1 | -0.16 | 0.22 | 0.28* | | | | | |
| | KBSH 44 | -0.10 | -0.27* | 0.19 | | | | | |
| 100-seed weight (g) | CO 4 | 0.01 | 0.00 | -0.12 | 0.25 | | | | |
| | Morden | 0.19 | 0.28* | 0.14 | 0.27* | | | | |
| | TNHSF 239 | -0.16 | 0.05 | -0.14 | 0.03 | | | | |
| | TCSH 1 | 0.12 | -0.11 | 0.16 | 0.14 | | | | |
| | KBSH 44 | -0.01 | -0.06 | 0.02 | 0.44 | | | | |
| Volume weight/100 ml (g) | CO 4 | 0.00 | 0.11 | 0.26 | 0.14 | 0.50** | | | |
| | Morden | 0.12 | 0.23 | -0.09 | 0.08 | 0.23 | | | |
| | TNHSF 239 | -0.01 | 0.14 | -0.30* | -0.10 | 0.13 | | | |
| | TCSH 1 | -0.09 | -0.08 | 0.25 | 0.24 | 0.33* | | | |
| | KBSH 44 | 0.05 | -0.18 | -0.02 | 0.07 | 0.43** | | | |
| Oil content (%) | CO 4 | -0.17 | -0.26 | -0.10 | 0.24 | 0.20 | -0.02 | | |
| | Morden | 0.09 | 0.39** | -0.07 | 0.27* | 0.14 | 0.42** | | |
| | TNHSF 239 | -0.09 | -0.01 | -0.07 | 0.04 | 0.24 | 0.18 | | |
| | TCSH 1 | -0.18 | 0.32* | -0.05 | -0.18 | -0.16 | -0.13 | | |
| | KBSH 44 | 0.18 | 0.17 | 0.04 | -0.31* | 0.01 | 0.28* | | |
| Seed yield/plant (g) | CO 4 | -0.16 | -0.03 | 0.05 | 0.17 | 0.62** | 0.65** | 0.21 | |
| | Morden | 0.21 | 0.32* | 0.03 | 0.19 | 0.51** | 0.16 | 0.22 | |
| | TNHSF 239 | -0.13 | 0.04 | 0.00 | -0.03 | 0.86** | 0.09 | 0.19 | |
| | TCSH 1 | -0.07 | 0.04 | 0.32* | 0.41** | 0.35** | 0.41** | -0.22 | |
| | KBSH 44 | -0.16 | -0.18 | 0.13 | 0.70** | 0.58** | 0.16 | -0.20 | |
| Oil yield/plant (g) | CO 4 | -0.17 | -0.09 | 0.04 | 0.21 | 0.59** | 0.58** | 0.48** | 0.95** |
| | Morden | 0.22 | 0.36** | 0.03 | 0.22 | 0.50** | 0.22 | 0.34* | 0.99** |
| | TNHSF 239 | -0.15 | 0.03 | -0.03 | -0.01 | 0.85** | 0.12 | 0.35** | 0.98** |
| | TCSH 1 | -0.16 | 0.15 | 0.32* | 0.35** | 0.29* | 0.37** | 0.14 | 0.93** |
| | KBSH 44 | -0.11 | -0.17 | 0.14 | 0.67** | 0.59** | 0.19 | -0.09 | 0.99** |

*,** significant at 5 and 1 percent, respectively

**Seed yield *vs* other characters**

Significant and positive associations were recorded between seed yield and 100-seed weight in both hybrids and varieties. It indicated that the character 100-seed weight affects the seed yield in hybrids and varieties alike and hence it is important for seed yield improvement. Several authors, namely, Pathak (1975), Shabana (1975), Singh *et al.* (1977), Lakshmanaiah (1978), Anand and Chandra (1979), Giriraj *et al.* (1979), Omran *et al.* (1979), Rao (1983), Shinde *et al.* (1983), Caylak and Emiroglu (1984), Dhaduk *et al.* (1985), Mishra *et al.* (1985), Singh *et al.* (1985), Diaz *et al.* (1986), Abdel *et al.* (1987), Vanisree *et al.* (1988), Niranjana-murthy and Shambulingappa (1989), Visic (1989 and 1991), Singh and Labana (1990), Pathak and Dixit (1990), Khan and Islam (1991) and Chaudhary and Anand (1985), also reported of having observed a positive association between seed yield and 100-seed weight. However, Shrinivasa (1982) and Tariq *et al.* (1992) reported a negative association between seed yield and 100-seed weight. Non-significant association between these characters was also reported by Vidhyavathi *et al.* (2005).

Head weight had significant and positive correlations with seed yield in the hybrids but not in the varieties. Hence, this character is not of much importance for the yield improvement of varieties. Head diameter, stem girth and volume weight had significant and positive associations with seed yield in some varieties and hybrids only. Hence, generalized association for hybrids or varieties was not observed. However, Singh and Labana (1990), Khan and Islam (1991), Chaudhary and Anand (1993), Mogali (1993), and Vidhyavathi *et al.* (2005) reported of having found positive associations between head diameter and seed yield.

Likewise, positive associations between stem girth and seed yield were reported by several authors, namely, Pathak and Dixit (1990) and Gangappa and Virupakshappa (1994) and Lakshmanaiah (1978). However, Vidhyavathi (2005) reported no association between seed yield and volume weight.

**Volume weight**

Volume weight had significant and positive associations with 100-seed weight in the hybrids and the variety CO 4. It indicated that 100-seed weight is more important for deciding the volume weight in hybrids than in varieties. This might be due to the heterotic vigor of the hybrids expressed for 100-seed weight.

**Associations between other characters**

The association of other characters was observed in individual varieties and hybrids but generalized trend was observed neither for the hybrids nor for the varieties. Hence, these characters are less dependable.

## CONCLUSION

From the foregoing discussion it may be concluded that the characters seed yield and 100-seed weight are important selection indices for oil yield improvement in both varieties and hybrids. Head weight can be considered as a useful selection index for the improvement of seed yield and oil yield in sunflower hybrids only. Likewise, oil content is important for oil yield improvement in varieties only. It may also be concluded that the results obtained from the association analysis of data for the varieties and hybrids will give ambiguous results. This may have an adverse impact on the yield improvement program. Hence, association analyses computed separately for each variety and hybrid is always desirable to identify suitable selection indices for sunflower improvement.

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## PATRONES DE ASOCIACIÓN ENTRE ATRIBUTOS LIGADOS AL RENDIMIENTO EN VARIEDADES E HÍBRIDOS DE GIRASOL (*Helianthus annuus* L.)

RESUMEN

Se seleccionaron para este estudio tres variedades llamadas CO 4, Morden, TNHSF 239 (variedad precomercial) y dos híbridos TCSH 1 y KBSH 44. Se estimaron coeficientes de correlación simples entre caracteres para cada variedad e híbrido separadamente. Los atributos rendimiento de semilla y peso de 100 semillas son importantes índices de selección para el mejoramiento del rendimiento de aceite tanto para variedades como híbridos. El peso del tálamo puede considerarse un índice de selección para el mejoramiento del rendimiento en semilla y aceite sólo en el caso de los híbridos. De manera similar, el contenido de aceite es un índice de selección importante para la mejora del rendimiento de aceite sólo en el caso de las variedades. Puede también inferirse que los resultados obtenidos de los análisis de asociación de datos en variedades e híbridos analizados en conjunto producirán resultados ambiguos y tendrían un impacto adverso en un programa de mejoramiento por rendimiento. Por lo tanto, siempre es deseable conducir análisis de asociación separados para cada variedad o híbrido para identificar índices de selección para el mejoramiento de girasol.

# LIENS ENTRE LES COMPOSANTES DE RENDEMENT CHEZ LES SORTES ET LES HYBRIDES DE TOURNESOL (*Helianthus annuus* L.)

RÉSUMÉ

Les trois variétés CO 4, Morden, TNHSF 239 (cultivar experimental) et les deux hybrides TCSH 1 et KBSH 44 ont été sélectionnés pour cette étude. Les coefficients de corrélation simple entre caractères ont été estimés séparément pour chaque variété ou hybride. La production de grains et le poids de 100 grains sont des indices de sélection importants pour l'amélioration du rendement en huile pour les variéts comme pour les hybrides. Le poids du capitule peut être considéré comme un index de sélection important pour le rendement en grain et en huile seulement pour les hybrides. De la même façon, la teneur en huile est un index de sélection important pour l'amélioration du rendement en huile seulement pour les variétés. Il peut également être inféré que les résultats obtenus en agrégeant les données des variétés et des hybrides aurait conduit à des conclusions ambiguës et aurait eu des effets néfastes sur le programme d'amélioration de la productivité. Ainsi il apparaît souhaitable, pour identifier des index de sélection pour l'amélioration du tournesol, de calculer séparément les corrélations entre caractères pour chaque variété et hybride.