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AN INVESTIGATION ON DIFFERENCES IN THE QUALITY OF SUNFLOWER SEEDS IN RELATION TO THEIR POSITION IN THE HEAD

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SUMMARY

This study was conducted in 1995 in Erzurum, Turkey, to determine changes in some quality characteristics in relation to the position of kernels on the head of five sunflower lines.

According to the results of the study, when progressing from the periphery to the center of the head, seed number, kernel percentage, 1000-seed weight, crude protein and oil content of hulled seeds decreased but crude protein and oil content of dehulled seeds did not differ.

Key words: Quality, sunflower, seed position, head

INTRODUCTION

In many countries sunflower is mainly grown for its edible oil as well as a snack. The main objective in crop production is to obtain high yielding and high quality crop. Achievement of this goal requires the use of appropriate cultivar for any region, high quality seed and application of proper management practices (Robinson, 1978; Majid and Schnettier, 1988; Oral and Kara, 1989).

The filled and large seeds at full physiological maturity have a high quality but their quality varies greatly with the position of achenes in the head, depending on cultural practices and cultivar used, and have a great importance for the use as seed (Robinson, 1978; Yu, 1982; Pathak and Prosad, 1988). On the other hand, important quality characteristics such as the kernel percentage, size of achenes, crude protein content and crude oil content also differed with various management practices, cultivar and achene position in the head (Konstantinov *et al.*, 1977; Robinson, 1978). These differences are considered as important selection criteria in cultivar development programs. This study was initiated to investigate the changes in some quality characteristics in relation to the position of achenes on the head of five sunflower lines.

MATERIAL AND METHOD

A field experiment was carried out in 1995 at the Ataturk University Research Farm in Erzurum, Eastern Anatolia, Turkey (39°55'N, 41°16'E, altitude1950 m). The site has a loamy soil. The average temperature and rainfall change 9.5, 13.7, 18.7, 15.3°C and 40.1, 65.1, 13.4, 10.0 mm from sowing to emergence, from emergence to head formation, from head formation to flowering, from flowering to maturity, respectively. In this study, the lines selected by Karadogan and Ozgodek (1994) under the Erzurum conditions were used to determine some quality characteristics in terms of seeds position in the head. Line 1, 2, 3, 4 and 5 were obtained from Corum, Amasya, Edyrne, Budur and Erzurum ecotypes respectively, using mass selection methods. The experiment was established in factorial design with four replication. The experiment area was irrigated when the available moisture reached 20% of field capacity. The changes in quality characters with position of seeds in the head were evaluated from ten randomly selected heads from each of the two middle rows of the four-row plots. Seed lots of each group were mixed in three rows starting from the periphery to the center for quality analysis. For each group, seed number, 1000-seed weight, kernel percentage, crude protein and oil content of hulled and dehulled seeds were determined for each plot at maturity.

RESULT AND DISCUSSION

Seed number

On an average, seed number decreased remarkably from the periphery to the center of the head. This reduction differed with the lines. Lines 1 and 2 exhibited a linear decrease whereas lines 3, 4 and 5 did not follow this trend. It is not surprising that seed number decreased from the periphery to the center (Figure 1). The magnitude of reduction, however, varied with the lines used in this study. The results may be attributed to the differences in the morphological structure of the heads of the lines (Knowles, 1978) and unfertilized flowers in the outer part of the head of some lines.

Kernel percentage

Although the kernel percentage decreased in the center as compared with the outer part of the head, the reduction observed due to the position of seed in the head was highly significant after row 12 from the periphery (Figure 2). The lines showed significant differences with regard to changes in kernel percentage. For example, in line 3, kernel percentage did not change significantly from the outer part to the center of the head, whereas significant changes occurred in the center of the head in lines 1 and 4, and after the row 12 in lines 2 and 5. This situation caused a significant line x position interaction.

Reduced availability of assimilates and later maturation of seeds in head center compared with the outer parts were most likely the cause of the reduction in the kernel percentage observed towards the head center. Pathak and Prosad (1988) reported that kernel percentage from the periphery to the center decreased, but Ivanov *et al.* (1980), however, observed that there was no change in this component. The contradictory results were attributed largely to the use of different cultivars/lines in these studies.

1000-seed weight

Averaged over the lines, 1000-seed weight was significantly affected by the position of seeds in the head and it decreased from the periphery to the center. The rate of reduction varied among the lines; in lines 1, 2 and 5, 1000-seed weight was significantly lower in seeds from the central zone than in seeds from the outer or middle zones whereas in the other two lines shifts on position of seeds in the head were not significant (Figure 3). This was probably due to earlier maturation and production of more filled seeds (Figure 2) in the outer zones of the head.

There was a significant line x position interaction for 1000-seed weight (Figure 3). The interaction was mainly caused by variability in maturity periods among the lines. In other studies, Ivanov *et al.* (1980) demonstrated that 1000-seed weight was not influenced by the position of seeds in the head, while Youssef and Abdel-Rahmn (1977) and Yu (1982) reported that seeds at the center of the head had lower seed weight than those on the periphery. These results may differ due to the genetic attributes of the cultivars grown.

Crude oil content of hulled seeds

Generally, oil percentage of whole sunflower seeds depends on both the percentage of hull and the percentage of oil in the kernel. In this study crude oil content of hulled seeds from the outer zone to middle zone showed slight increase but thereafter decreased significantly from the middle zone to the center. Crude oil content of hulled seeds varied significantly among the lines. The reduction was more marked in lines 1 and 2 (Figure 4). The decline in the oil content of hulled seeds in the inner zone could be a result of a decrease in the kernel percentage from the outer zone to the inner zone. The results from our study were similar to those observed by other investigators (Lencrerot *et al.*, 1977; Youssef and Abdel-Rahman, 1977).

Crude oil content of dehulled seeds

Although crude oil content of dehulled seeds increased slightly from the outer zone to the middle zone but decreased thereafter. This change was not significant (Figure 5), and the non-significant reduction observed in the inner zone of the head was apparently caused by the higher percentage of hulls and the formation of smaller seeds.

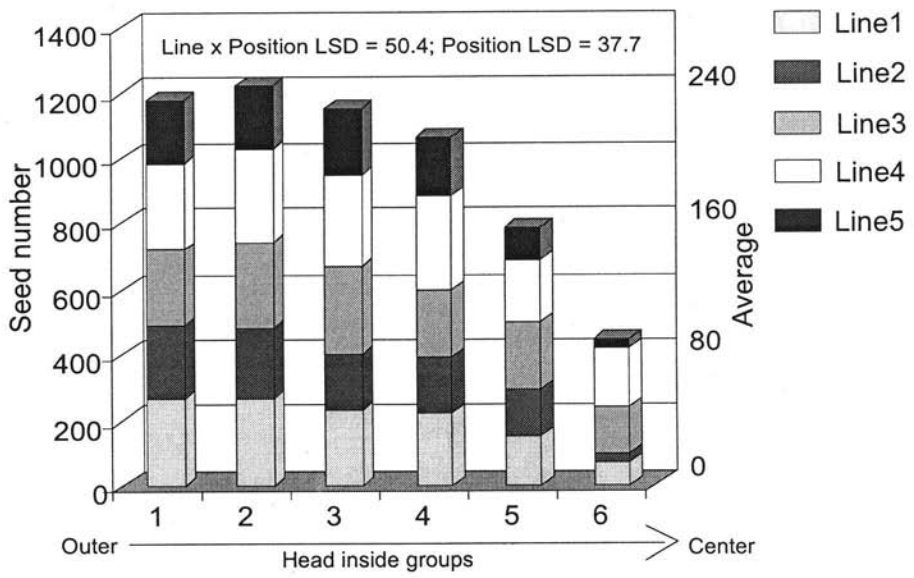

Figure 1: Changes in seed number of sunflower lines in relation to the position on the head

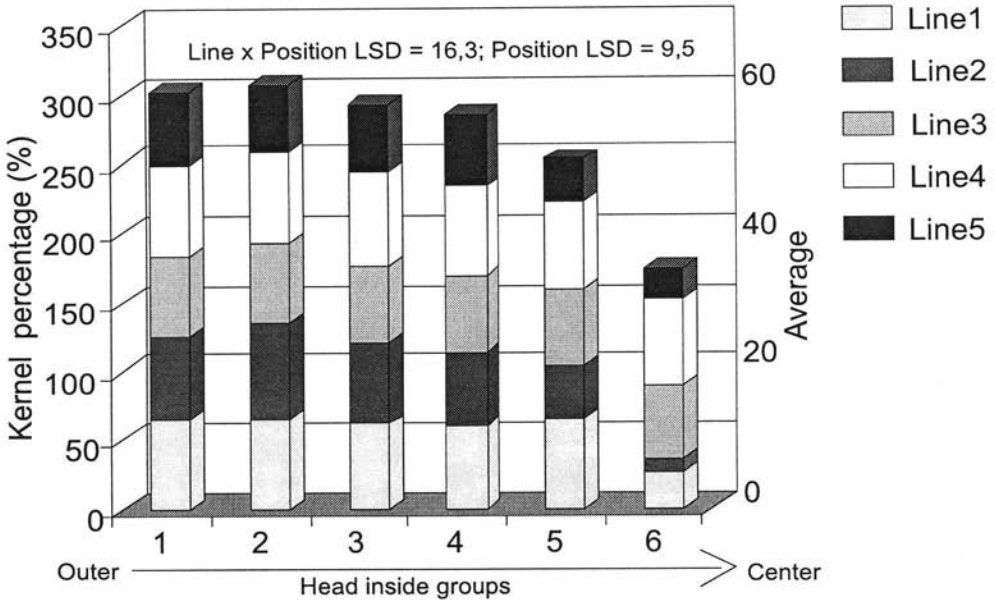

Figure 2: Changes in kernel percentage of sunflower lines in relation to the position on the head

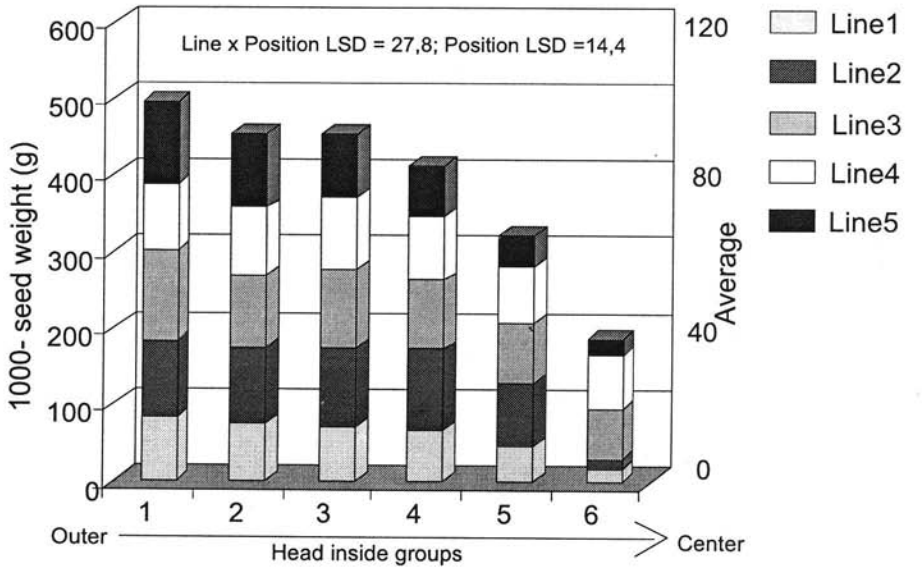

Figure 3: Changes in 1000-seed weight of sunflower lines in relation to the position on the head

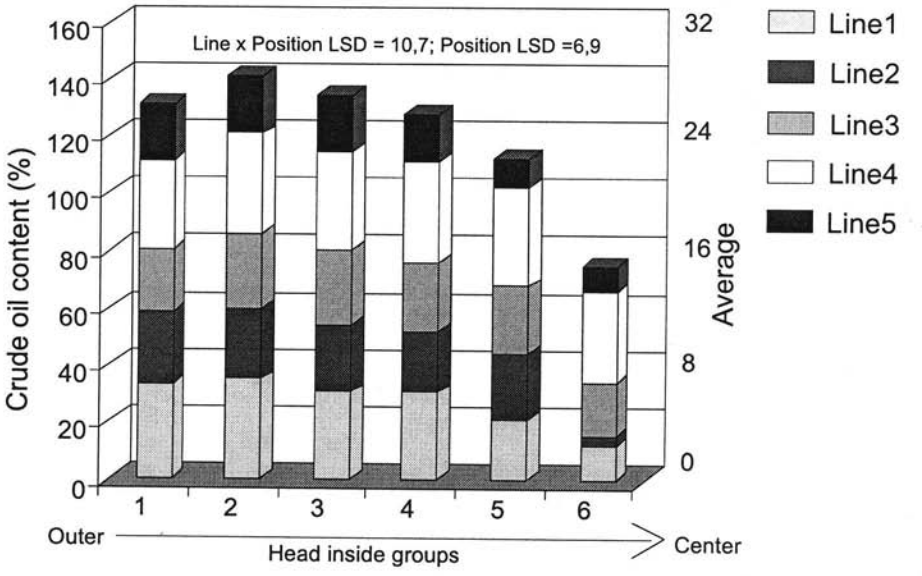

Figure 4: Changes in crude oil content of hulled seeds of sunflower lines in relation to the position on the head

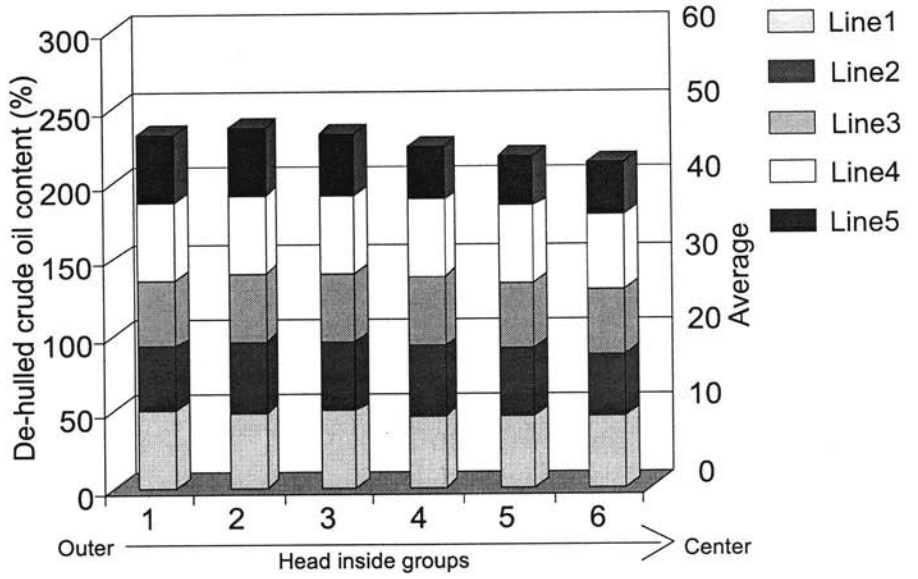

Figure 5: Changes in crude oil content of dehulled seeds of sunflower lines in relation to the position on the head

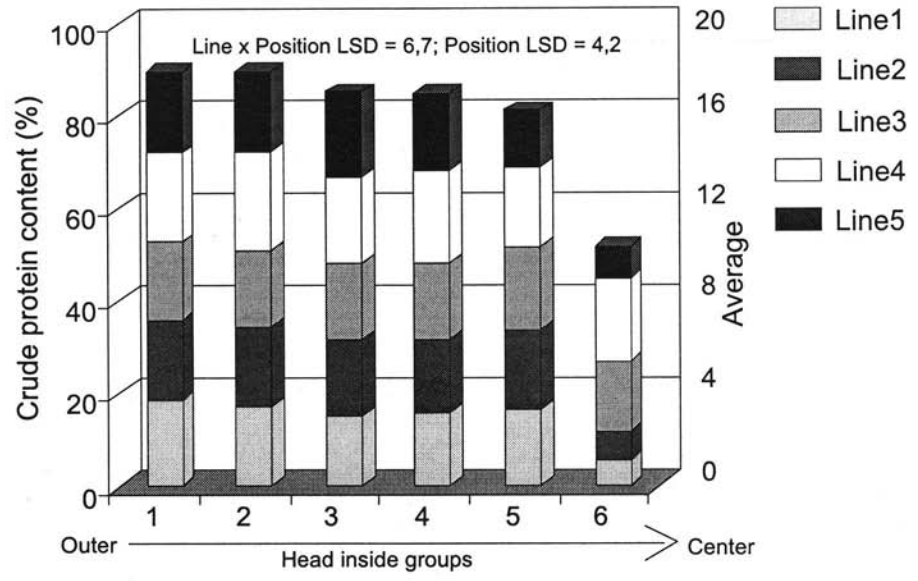

Figure 6: Changes in crude protein content of hulled seeds of sunflower lines in relation to the position on the head

Crude protein content of hulled seeds

There was a small decline in crude protein content of hulled seeds from the periphery to the center of the head, but this reduction was highly significant in the center. The lines studied were found to differ greatly for this characteristic with the exception of lines 3 and 4 (Figure 6).

This situation may be attributed to genetic variability among the lines or to greater reduction in the kernel percentage in some lines. In earlier studies, Youssef and Abdel-Rahman (1977) suggested that crude protein content of hulled seeds was higher in seeds from the central zone than in those from the outer or middle zone, and Ivanov *et al.* (1980) found that the chemical composition of seeds obtained from the outer, middle and central parts of a flower head was almost similar and the differences observed were not significant. These contrasting results may also have been the results of the use of different cultivars.

Crude protein content of dehulled seeds

There was a tendency for crude protein content of dehulled seeds to increase from the outer edge to the center of the head. Regardless of the line, the decline was not significant (Figure 7). Similar results were also observed by Ivanov *et al.* (1980).

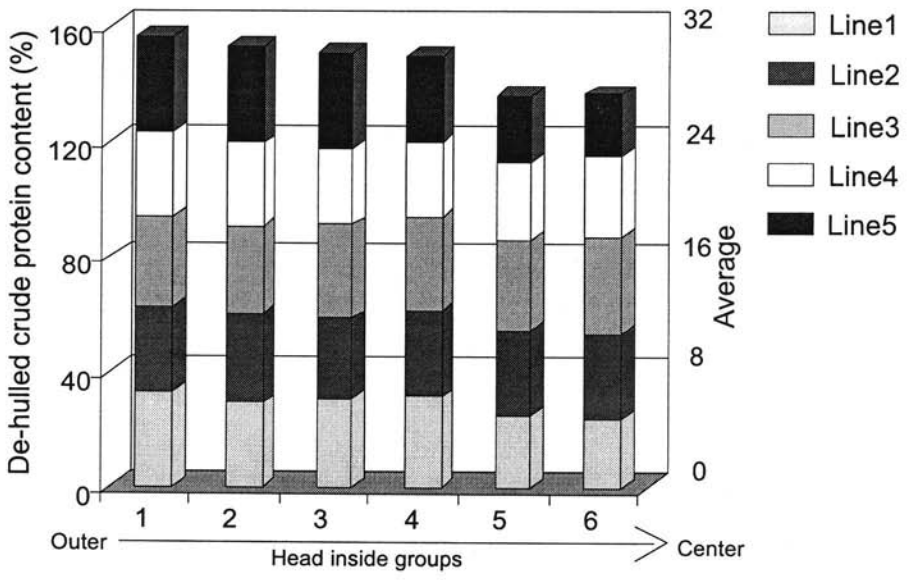

Figure 7: Changes in crude protein content of dehulled seeds of sunflower lines in relation to head position

In conclusion, quality attributes changed with the position of seeds in the head and consideration should be given to these variations in sunflower breeding and seed production.

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UNA INVESTIGACION SOBRE LA DIFERENCIA EN LA CALIDAD DE LAS SEMILLAS DE GIRASOL EN RELACIÓN A SU POSICIÓN EN EL CAPÍTULO

RESUMEN

Este estudio fue llevado a cabo para determinar los cambios en algunas características de calidad, en relación a sus posiciones en el capítulo, de cinco líneas de girasol en Erzurum, Turquía. De acuerdo con los resultados de este estudio cuando se progresa de la parte exterior al centro de capítulo, el número de semillas, el porcentaje de almendra, peso de 100 semillas, proteina y contenido de aceite de semillas sin descascarillar, decrecieron , pero los contenidos de proteína y de aceite de las semillas descascarilladas no variaron.

EFFET DE LA POSITION DES GRAINES SUR LE CAPITULE DE TOURNESOL SUR LEUR QUALITÉ

RÉSUMÉ

Cette étude a été menée pour déterminer les modifications des caractères de qualité des akènes, en relation avec leur position sur le capitule de cinq lignées de tournesol cultivées en 1995 à Erzurum, Turquie. Selon les résultats de cette étude, le nombre de grains, le pourcentage d'akènes, le poids de 1000 grains, les teneurs en protéines brutes et en huile de graines décortiquées ne diffèrent pas lorsqu'on passe de l'extérieur vers l'intérieur du capitule.