Effect of Genotypes and Environments on Oil Content and Oil Quality Parameters and Their Correlation in Peanut (*Arachis hypogaea* L.)[1]

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ABSTRACT

The quality of edible oils is now receiving increasing consideration from consumers and processors. The present study was conducted to investigate the effects of environments on oil content and fatty acid composition in peanut. The correlation between oil content and oil quality parameters was also studied. Thirteen peanut (*Arachis hypogaea* L.) genotypes were grown in 12 environments for the study. Soils at experiment locations differed significantly for pH, EC, and N, P, Zn, Mn, and Fe contents. Significant genotype, environment, and genotype x environment interaction effects were observed for oil content, individual fatty acid contents, and derived oil quality parameters. The original range of 34-54% of oil content based on one season/location evaluation in these lines was not repeatable, and ranged from 45-50% in multilocation evaluation. Oil content was positively correlated with soil pH and Fe content. The correlation of oleic and linoleic acid content with soil pH and Fe content was positive in the former and negative in the latter. The oil content was positively correlated with O/L ratio. Oliec and linoleic acid contents were negatively correlated. Selection for reduced linoleic acid level in genotypes would also reduce levels of total long chain saturated fatty (TLCSF) acids. Of the thirteen genotypes tested, ICG 5856, ICG 5369, and ICGV 87124 could be used in breeding for improved oil quality.

Key Words: Groundnut, genotype x environment interaction, oil quality, soil nutrients.

Peanut (*Arachis hypogaea* L.), with an annual world production of 19 million t from 18 million ha, is a major annual oilseed crop. About two-thirds of the total peanut production is crushed for oil and the remaining one-third is used in confectionery products. With increasing consumer demand for edible oil of good quality, there is a need to investigate and understand various factors that influence peanut oil content and quality. The oil content of 8000 germplasm lines screened at ICRISAT Center, Patancheru, India, ranged from 31 to 55% (ICRISAT, unpublished data). However, these observations were based largely on single season/location evaluations. Earlier studies had revealed that genotypic differences for oil content were highly influenced by locations, seasons, and growing conditions (4, 7, 8, 15, 30, 31).

Nutritional quality of oil is determined by its fatty acid composition. Oleic, a monounsaturated acid, and linoleic, a polyunsaturated fatty acid, account for 75-80% of the total fatty acids in peanut oil. Oleic (O)/linoleic (L) acid ratio and iodine value (IV) are both indicators of oil stability and shelf life of peanut products (3, 4, 12). Peanuts with high O/L ratio and low iodine value have long product stability. Genotypic variation for fatty acid composition in peanut (3, 17, 21, 26, 28) and its interaction with environment (4, 8, 30, 31) are reported in the literature. Two major recessive genes have been identified in peanut which increase the oleic acid content to near 80% and reduce the linoleic acid content to around 2% (18).

Soil application of micro-nutrients such as sulphur and boron resulted in an increase in oil content (2, 6, 23). However, the reports on the effect of macro-nutrients are conflicting. The application of nitrogen either had a negative (2, 24) or no (25) effect on oil content whereas phosphorous had all three effects: no effect (25), positive (2, 11, 24), and negative (20). For potash, the effects were either positive (2, 11, 20) or negative (25).

The present experiment was designed to (i) study the effect of growing environments on oil content and fatty acid composition vis-a-vis soil nutrients, pH, and electrical conductivity (EC), (ii) measure the degree of relationship among fatty acids and between fatty acids and oil content and, (iii) select genotypes with high oil content and better fatty acid composition to breed improved peanut cultivars.

Materials and Methods

Ten peanut germplasm lines (ICG numbers), selected from the preliminary screening of 8000 lines, an improved breeding line ICGV 87124, and two cultivars, ICGV 87123 and JL 24, were selected for the present study. Details of the thirteen genotypes are given in Table 1.

The trial was grown in a randomized complete block design with three replications during two rainy (1988 and 1989) and two postrainy (1988/89 and 1989/90) seasons at two to four locations, resulting in 12 growing environments in India as described in Table 2. Each treatment was represented by four-row plot of 4-m length, with plants spaced at 30 x 10 cm.

1. Soil analysis

After fertilizer application, surface (0-15 cm) soil samples were collected

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