EFFECT OF ENVIRONMENT ON COMPOSITION OF SOYBEAN SEED

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BREEDING and selection work to develop improved strains of soybeans with respect to yield and other agronomic characters has been carried on by experiment stations for the last two or three decades. With the inauguration of the U. S. Regional Soybean Industrial Products Laboratory as a cooperative undertaking by the U. S. Dept. of Agriculture and the 12 states of the North Central Region, a more extensive breeding program became possible, using chemical analysis of adapted standard varieties, selections, and introductions as a further basis for selection.

Before these chemical data could be properly evaluated, however, it was found necessary to study effect of seasonal and soil differences on composition of varieties and strains.

MATERIALS AND METHODS

For the purpose of measuring the effects of variety, soil, climate, and fertilization, cooperative plantings were made at selected locations in the five states, Illinois, Indiana, Iowa, Ohio, and Missouri, comprising the principal soybean growing belt of the North Central Region. Where possible, existing rotations and soil treatment plots available at the experiment stations were utilized, while in other cases new field plots were established, employing randomized block designs to compensate more adequately for soil variability.

All soybean seed samples were harvested, threshed, and sent to the Laboratory at Urbana where they were placed in an especially constructed storage room under conditions of constant temperature and humidity for a sufficient period prior to analysis to permit the moisture content to come to equilibrium with the room condition. A room temperature of 70°F with a relative humidity of 20% has been found desirable to compensate more adequately for soil variability.

Oil content was determined in duplicate by the solvent method, using Skelly-solve F in Butt type extractors, with regrinding of the sample after the first two hours to insure complete extraction. The solvent was removed from the oil by heating on a steam bath for 45 minutes. The oil from this determination was used for obtaining the iodine number (Wijs) as well as the refractive index. Nitrogen was determined by the Kjeldahl-Gunning-Arnold method and the factor 6.25 used to calculate protein content. Total sugars were determined by acid hydrolysis of the alcoholic extract using the Scales method, and calculated as invert sugar. Ash percentage was obtained by dry ashing for 3 hours at 600° C. Phosphorus, calcium, and potassium were determined in the usual A. O. A. C. methods. All analyses are reported on a moisture-free basis.

EXPERIMENTAL RESULTS

In order to measure variation in composition of soybean seed due to variety, ten of the best varieties and strains grown in the region were selected for four years beginning with 1936 at each of the experiment stations of Illinois, Indiana, Iowa, Missouri, and Ohio.

Varieties and strains were selected to include early, medium, and late types, the variety Mandarins being the earliest of the group. During the four years, Mandarins has averaged highest in protein content, next to Peking (a forage type) the lowest in oil, and nearly the lowest in total sugars. The variety Dunfield, ordinarily classified as a high oil type, has been consistently high in per cent oil and average for all seasons and in all years, the values being highly significant. Associated with this high oil content is consistently low protein content, the lowest of all varieties studied except Peking which is not grown for processing and was included in the test to enlarge the range of genetic types. The data differ widely in iodine number of the oil, an important value in the selection of oil for use in paints and varnishes. Table 1 gives the means of the analyses of these ten varieties grown in the five locations during the seasons 1936-39. In this table the means for the varieties are based on analyses of these ten varieties grown in the five locations during the 4 years, the means for years are based on analyses of the 10 varieties grown in the five locations during the 4 years, and the means for years are based on analyses of the 10 varieties at the five locations.

Analysis of variance of these data, given in Table 2, show a highly significant variation in protein oil content and iodine number between varieties.