STUDIES ON MATURITY, YIELD, UNDERWATER WEIGHT AND SOME OTHER CHARACTERS OF POTATO PROGENIES

B. MARIS

Institute of Plant Breeding (I.v.P.), Wageningen, The Netherlands

Received 24 March 1969

SUMMARY

In 1965 the relation between maturity, tuber yield and under water weight was studied in 756 unselected fourth-year potato clones of twelve crosses. Other characters studied were seed potato weight, date of emergence, plant height, general impression of the tubers at lifting, tuber weight and payment weight, as the above relation could be influenced by or depend on these characters.

The experiments were carried out on a clay soil at Wageningen. The experimental design was a partially balanced lattice with four replications and five plants per plot.

The clone means, corrected according to F-values for blocks, were used for determining normal correlation coefficients between all possible combinations of characters per population as well as for composition of frequency distributions and of population means with coefficients of variability. To estimate heritabilities within the populations the separate data of the four replications per clone were used.

In 1966 the investigations were continued with 136 selected clones on both clay and sandy soil. In addition to the statistical operations used in 1965, normal correlation coefficients were calculated between the years and between the soil types using corrected clone means. The results are given and discussed.

INTRODUCTION

Data published by Hogen Esch and Zingstra (1962) on a large number of potato varieties point to a positive correlation between maturity and starch content. Analyzing 513 potato varieties Zadina (1963) also found a positive correlation between these two characters. Rudorf and Baerecke (in Kappert and Rudorf, 1958, p.144) believe that there is little chance to increase starch content in early varieties in view of the physiological correlation between short period of vegetation and low starch content.

On the contrary Thikonov and Demidović (1935) report that earliness and starch content are not correlated. Analyzing 2,508 clones of 29 crosses, Maris (1962) also failed to find a distinct correlation between maturity and under water weight (a measure of dry matter and starch content). Möller (1965) selected very early clones which

1 Present address: Foundation for Agricultural Plant Breeding (S.V.P.), Wageningen, The Netherlands.
B. MARIS

contained very high starch content. Growing potato clones at Baton Rouge, Louisiana, JOHANSEN et al. (1967) even found that earliness and a high starch content were positively correlated; the same material, grown at Grand Forks, North Dakota, produced no correlation.

It was initially believed that earliness and high starch content could not be combined. More recent investigations apparently have disproved this. Why then have no commercial varieties of this combination been bred? The answer seems to be that such a combination will always entail another unwanted character. In this respect it has fairly commonly been taken for granted that it should be extremely difficult, if possible at all, to combine a high starch content and a high tuber yield. Yet there are some examples mainly of late varieties with high starch content and very good yield. Some of the early clones with high starch content selected by MÖLLER (1965) have tuber yields equal to or higher than other early varieties. BÖRGER et al. (1954) found no evidence of any negative correlation between starch content and tuber yield. In doing their experiments they took no account of maturity.

The aims of the study described in the present paper have been to determine the relation between maturity, tuber yield and under water weight. At the same time the material used in the experiments was analyzed for some other characters that might influence these relations.

Since part of the material was analyzed for the same characters in two successive years, it was possible to calculate for each character the extent of agreement between the years. This is important in view of the policy to be adopted for selecting for various characters. Previous studies made by among others MARIS (1962, 1966), PFEFFER (1963) and HOWARD (1963) have shown that many characters are markedly subject to modification. When selection for such characters is strong and only one or a few plants can be judged serious errors will be inescapable.

Segregation ratios and frequency distributions give information about inheritance and variability. However, characters influenced by environmental factors often show a considerable degree of variability even within a variety or clone. Therefore not all variability is based on genetic differences. To estimate genetic variation, heritabilities are calculated. The results show whether or not it makes sense to select for the character in question. However, the absence of demonstrable genetic variation does not necessarily imply that there are no genetic differences. When another lay-out is adopted for the experiments – larger plots, more replications, various locations – differences, if any, can often be demonstrated.

Also in the present study heritabilities were estimated.

MATERIAL AND METHODS

In 1961 1,116 seedlings were raised from true seeds of 12 crosses between 13 potato varieties of the species *Solanum tuberosum* L. According to maturity of the parents, the crosses represented combinations of very early × very early (6 crosses), medium early × very early (3), medium early × medium early (1), late × very early (1) and late × late (1). According to under water weight they consisted of low × low (5), low × medium (2), high × low (2), high × medium (2) and high × high (1).

Most seedlings yielded a few small tubers. Therefore only two plants per clone were