

## NOTE ON A PERICLINAL CHIMAERA IN THE POTATO.

BY M. B. CRANE.

(*John Innes Horticultural Institution, Merton, London.*)

(With Plate III.)

THE potato variety Golden Wonder was distributed in 1906. Its parentage is unknown, but on account of various similarities it is generally assumed that it arose as a somatic variation from the variety Langworthy.

The following experiment was an attempt to elucidate the somatic relationship, if any, between the two varieties.

The tubers of Golden Wonder have a thick brown russet skin, whilst those of Langworthy have a thin white smooth skin (see Plate III). In other morphological respects these varieties are similar, *i.e.* in habit of growth, foliage and flowers they are indistinguishable. In certain physiological characters, however, they again appear to differ. Langworthy is generally considered to give a higher yield and also to be more floury when cooked than Golden Wonder. Considerable differences have also been reported (Ellison, 1935) between the chromosome complements of the varieties.

According to Salaman (1926) Langworthy was sent out under its present name about 1905, but it was distributed at a much earlier date under the name of Maincrop, which was the original name of this variety. It was derived as a seedling from the variety Early Rose some time before 1876.

In a series of illuminating experiments Asseyeva (1928), by the simple process of removing the eyes of potato tubers to a depth of about 1 mm., and thereby inducing adventitious buds to form from internal tissue, demonstrated that a number of varieties commonly grown in Russia were of chimerical constitution. Her method was adopted in this experiment.

Twenty-four tubers of Golden Wonder were used as follows: Twelve tubers were cut in halves longitudinally. On one half the eyes and the surrounding tissue were removed to a depth of approximately 1.5 mm. On the other, the control half, the eyes were left without interference.

Six whole tubers had all visible eyes removed, and six were left as controls. Twenty-four tubers of Langworthy were used in a similar way, twelve half and six whole tubers being treated, and a similar number used as controls.

All the visible eyes were removed at the end of February and the tubers were placed on coconut fibre in shallow boxes in a heated greenhouse. The fibre was kept moist and the boxes covered to exclude light. From time to time the tubers were examined and any growth on the treated tubers which did not appear to be of adventitious origin was removed. It is possible, however, that some of the shoots which were left may not have developed from internal tissue; those, for example, which developed near the periphery of the cut.

The tubers were planted at the beginning of May, harvested in the middle of September, and the results were as follows:

TABLE I.

*Golden Wonder.*

Twelve half-tubers, eyes removed		Twelve half-tubers, controls	
$A_1$	Tubers all white, smooth skin	$A_2$	} Tubers all brown, russet skin
$B_1$	" "	$B_2$	
$C_1$	" "	$C_2$	
$D_1$	Died	$D_2$	
$E_1$	" "	$E_2$	
$F_1$	29 tubers smooth, 8 russet	$F_2$	
$G_1$	Died	$G_2$	
$H_1$	" "	$H_2$	
$I_1$	" "	$I_2$	
$J_1$	Tubers all white, smooth skin	$J_2$	
$K_1$	" "	$K_2$	
$L_1$	36 tubers smooth, 1 russet	$L_2$	
Six whole tubers, eyes removed		Six whole tubers, controls	
$M_1$	Tubers all brown, russet skin	$M_2$	} Tubers all brown, russet skin
$N_1$	Died	$N_2$	
$O_1$	Tubers all white, smooth skin	$O_2$	
$P_1$	Died	$P_2$	
$Q_1$	Tubers all brown, russet skin	$Q_2$	
$R_1$	Tubers all white, smooth skin	$R_2$	

*Langworthy.*

Only one treated half tuber of Langworthy died, the other eleven halves and the six whole treated tubers gave all thin white smooth-skinned tubers. The controls also gave all white and smooth-skinned tubers. The habit of growth, foliage and flowers of all the plants derived from treated and untreated tubers both of Golden Wonder and Langworthy were indistinguishable.

The untreated Golden Wonder tubers gave tubers all with a thick brown russet skin. Of the treated half and whole tubers seven died,

seven gave all white smooth-skinned tubers, two gave some brown russet tubers in addition to a majority with a white smooth skin, and two gave all brown russet tubers. It is to be presumed that the brown russet tubers which developed on the treated material came from shoots which did not arise from internal tissue. As previously mentioned, some of the shoots which developed near the edge of the cut surface may have been of this kind, and again after planting shoots may have developed normally on untreated parts of the tubers. In the early stages of growth shoots which arise normally develop more rapidly than those of adventitious origin. It is therefore conceivable that normal shoots would have an advantage over adventitious shoots.

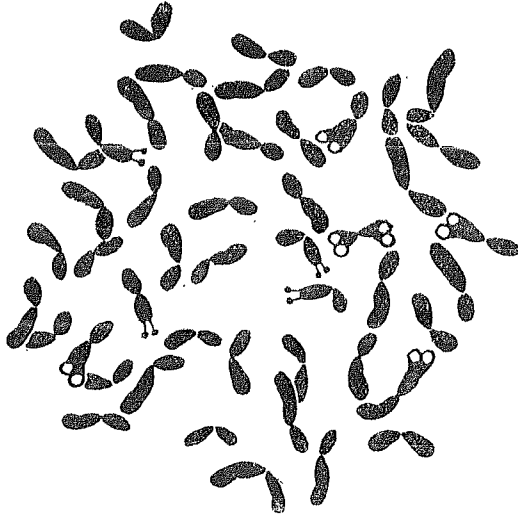
The results clearly indicate that Golden Wonder is a periclinal chimaera with an inner core which corresponds to Langworthy. Nevertheless under ordinary vegetative reproduction Golden Wonder is extremely stable. I am aware of only one reference, Salaman (1930) to a somatic variation of this variety. In this case Salaman illustrates a tuber of Golden Wonder which is in part white and smooth, and states that vegetative propagation from the different parts gave brown and russet, and white and smooth clones respectively, the latter corresponding in every way to Langworthy. Salaman described the tuber as a sectorial chimaera. There is but little doubt, however, that it was a mericlinal variation, *i.e.* an incomplete periclinal chimaera.

The literature on the genetics of the potato shows a number of exceptional results, *e.g.* in certain cases a certain character behaves as a dominant, in others the same character behaves as a recessive. Since chimaeras appear to be of frequent occurrence in the potato it is at least plausible that some of the conflicting results may be due to this cause.

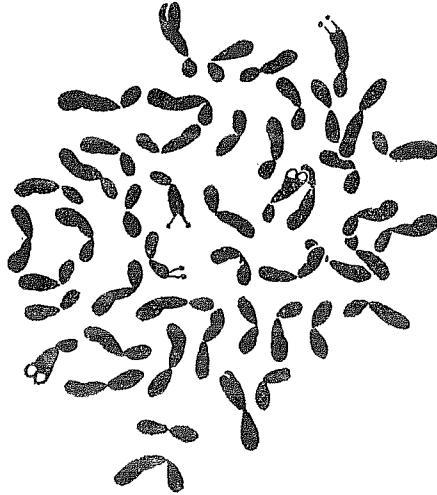
The somatic stability of Golden Wonder suggests that it might be possible to obtain desired periclinal forms by the cross-grafting of potato varieties.

In recent years russet-skinned forms of the potato varieties Great Scot and Up-to-Date have appeared. The new russet forms have been named Sefton Wonder and Field-Marshal respectively. McIntosh (1927) states: "In the numerous seedlings obtained by crossing ordinary varieties with Field-Marshal and Golden Wonder (both russets) not one has had a russet tuber." This general statement indicates that Field-Marshal is also a periclinal chimaera, and since the russet character does not reappear in their offspring it is probable that in this variety and also in Golden Wonder that the russet character is genetically confined to the external layer.

Since Golden Wonder is a periclinal chimaera, with an inner core of Langworthy, and particularly if only a single layer is involved in consti-

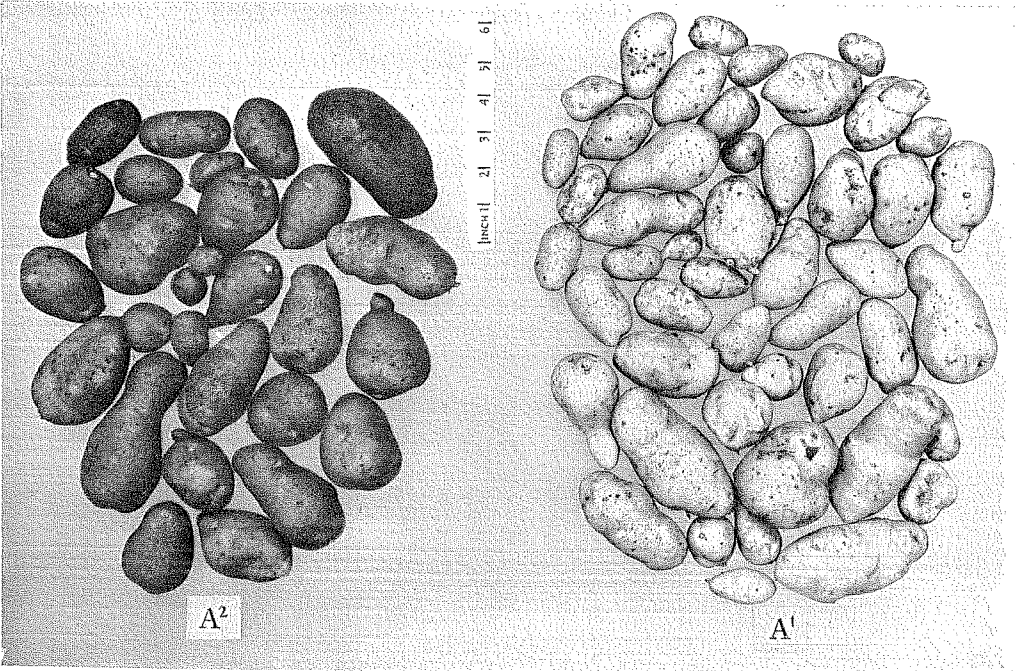
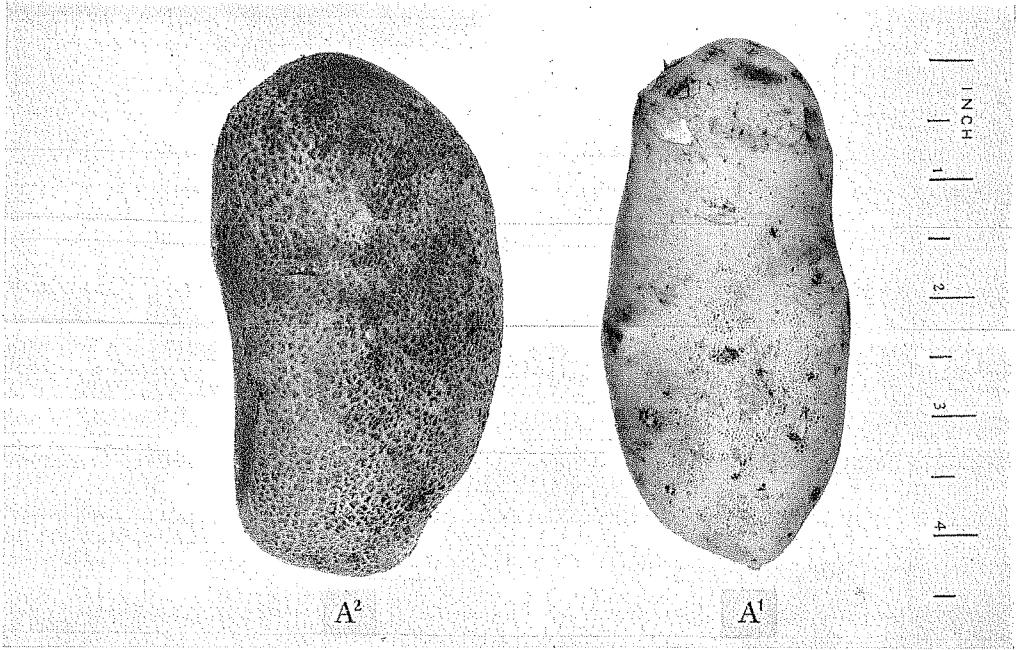


Text-fig. 1. The somatic chromosome complement of the potato variety Langworthy ( $\times 6000$ ).



Text-fig. 2. The somatic chromosome complement of the potato variety Golden Wonder ( $\times 6000$ ).

tuting the difference between these varieties, the cytological observations of Ellison (1935) are indeed remarkable. This investigator states that cytologically there is a marked difference between these varieties. At



a magnification of 5000 Golden Wonder has four chromosomes 16–14 mm. long and four 14–12 mm. long, whilst Langworthy has none over 12 mm. in length. Since the root tips, from which the observations were made, would all originate from Langworthy tissue, further detailed studies of the chromosome complements of these varieties should prove of interest.

Since the above note was prepared, cytological material has been examined by Miss Upcott, who reports as follows:

“Ellison (1935) has stated that the somatic complement of Golden Wonder differs from that of Langworthy in having a larger number of long chromosomes. According to the conclusions reached in the present study, the two complements should be identical. I have examined somatic plates from root-tips of each of these varieties (see Text-figs. 1, 2) and can distinguish no differences such as Ellison has described.”

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#### EXPLANATION OF PLATE III.

Tubers obtained from two halves of one potato of the variety Golden Wonder.

A<sup>2</sup>, from the control half tuber. All typically Golden Wonder, thick, brown russet-skinned tubers.

A<sup>1</sup>, from the treated half, eyes removed. All thin, white, smooth-skinned tubers characteristic of the variety Langworthy.