

CHANGE OF BONDED AND FREE TRYPTOPHAN CONTENT IN TUBERS OF GERMINATING POTATOES

(Physiological study of the potatoes X)

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It has been demonstrated by several investigators (LEFÉVRE 1938, LINSER 1938 and 1939, BERGER and AVERY 1944, LARSEN 1944 etc.) that about 70% of the total growth substance of plants poor in such substances and of plant organs consist of indol-like substances. LINSER, MAYR, MASCHER (1955) found several compound of indol structure in the cabbage species all occurring during the tryptophan metabolism. The tryptophan, with very slight reduction, yields partly decomposition products of growth substance character, partly of other nature.

The aim of our studies was to establish how is the relation of the free and bonded tryptophan in certain parts of the tuber, as a precursor of the indol growth substances, changing during the germination.

«Rose» of Kisvárdá was used in our experiments. The tubers were germinated (»jarovised«) at 20 °C, in humid atmosphere, with constant light and every seven days (on the days 1., 8., 15., 22., and 29. reckoned from the beginning of the experiment) they were cut into 4 parts according to the bipolar structure of the tuber (A = apical, B = girdl, C = basal and D = kernel or heart part (Fig.). The bonded and free tryptophan of each segment was determined by ROTHS' (6) method. The tuber segments were pulped, extracted with trichloric acetic acid and centrifuged. The decanted solution contained the free tryptophan, the solid phase contained the bonded one. Separately in each phase the concomitant substances were reduced to pulp and the yellow coloured, nitrated derivative were photometered in 3 cm. Ø cuvette, in three parallel runs, with S₄₃ filter.

Results and summary

The results may be examined from three different points of view, namely: the change of the bonded and free tryptophan separately in the single segments; the quantitative change of the total-tryptophan; and finally the formation of total-tryptophan content of the tubers in the single phases of the germination. (Fig. 1).

The free tryptophan content (Fig.) in the A, C and D segments is highest on the 8. day of the germination, then it diminishes, in the segments A and C, however, a second, smaller maximum appears on the 22. day. The free tryptophan content of the segment B remains almost unchanged during the entire

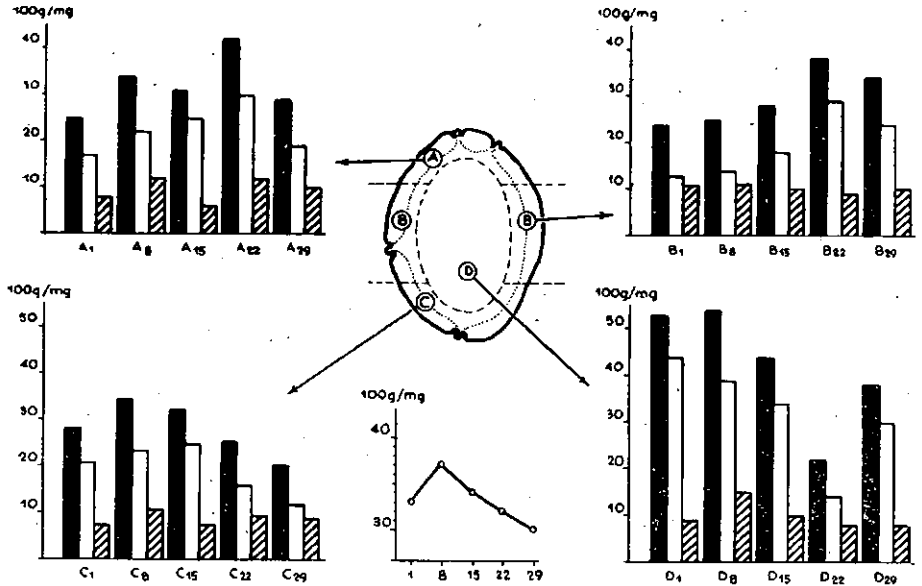


Fig. 1. Bonded (white)-, free (lined) and total-tryptophan (black) content in the single segment of the tubers.

germinative process with a slight tendency to decrease. The quantity of the bonded tryptophan in the segments A and B increases up to the 22. day, then decreases. This decrease in the segment C can be noted already from the 22. day. The bonded tryptophan content is the highest in the segment D and is gradually decreasing from the onset of the germination, on the 29. day, however, an other rise can be observed.

As the significant quantity of the tryptophan content is present in bonded form, the curves showing the formation of the total-tryptophan content run parallel with those of the bonded tryptophan. Taking the total-tryptophan content of the tubers in a lump, we may state that its quantity increases only in the first week of the germination, later constantly decreases. From the view-point of origin of the indol-structured compounds possessing the growth substance first and foremost the free tryptophan may be taken into consideration, and so it has to be primarily regarded at the developmental rate of the buds. The quantitative formation of the bonded tryptophan concerns us but indirectly, inasmuch as it may be assumed that the decrease of its quantity — in many instances significant — observed during the germination bears upon the level formation of the free tryptophan. At any rate the reduction of the quantity of the bonded tryptophan in the single segments may be ascri-

bed to its being transformed into free tryptophan which turning partly to decomposition products with growth-substance properties, gets in other parts of the tuber wherein is stored as free tryptophan or is being again used in secondary synthesis.

From the curves can be ascertained as follows:

1. The total-tryptophan content of the tubers increases during the first week of the germination followed by a gradual decrease (in the Fig. lined graph) which indicates that the tryptophan is really decomposed, utilized respectively during the tryptophan metabolism.

2. A considerable part of the tryptophan content of the tubers is formed by the bonded tryptophan.

3. Most of the bonded tryptophan is to be found in the heart (or kernel) of the tuber (*D* segment) the marked reduction of which, in view of the increasing quantity of the segments *A* and *B*, can be primarily interpreted by the fact that the indol of the growth-substances needed for the germination derives from here. Consequently the heart part of the tuber, as a tryptophan-reservoir, plays a considerable role — indirectly though — in the formation of the indol compounds required to develop the buds.

4. The significant increase of the bonded tryptophan content in the segments *A* and *B* can be explained so that the greater part of the free tryptophan released from the segment *D* may again infiltrate in the polipeptid chains. That is, the centrifugal migration of the free tryptophan is to be assumed. The quantitative increase of the bonded tryptophane of the segment *C* is so slight at the beginning of the germination that within the tuber a basifugal migration can not be assumed.

5. The slight quantitative fluctuation of the free tryptophan is unexpected, somewhat surprising. The curves clearly show that in the single segments there is a closely identical, permanent level, and to form the growth substances the molecules released from the bonded tryptophan are probably directly utilized: To wit, the rate of the release of the bonded tryptophan — supposing a more probable relation of the cause and effect — is dependent upon that of the utilization concerning both the growth substances and the secondary synthesis.

6. In the heart part of the tuber where there is no immediate utilization, the free tryptophan content tends also to decrease.

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