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CHANGES IN PROTEIN AND RNA DURING DORMANCY OF YAM TUBER TISSUES

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The dry weight, protein and RNA contents, changes in protein fractions were studied in the yam (*Dioscorea alata*), at weekly intervals from the day of harvest until sprouting commenced. The increase in dry weight, protein and RNA contents was gradual in the initial stages and rapid in the final stages. The electrophoretic studies on the soluble storage protein fractions showed that there were three fractions in the initial stages which increased to six at the end of the 8 weeks dormant period. Thus the "stable dormant period" becomes 4 weeks for yam (though sprouting takes place only in the 8th week after harvest). Termination of dormancy in the selected tuber seems to be initiated by an endogenous mechanism which may be genetically controlled.

Keywords : Dioscorea alata; Dormancy; Protein; RNA.

Hormonal control of resting buds and tubers has been reported[1-3]. Yet some recent research has established that the involvement of hormones either in the control of or in the breaking of dormancy is quite inconclusive. The role of proteins and nucleic acids in regulating dormancy is another factor which requires further investigations. Nucleic acid and protein synthesis are considered to be essential for the sprouting of potato buds[4-6].

The present work reports the changes in dry weight, moisture content, protein and RNA contents and in protein fractions during dormancy and early sprouting period of yam tubers *(Dioscorea alata)* stored in a controlled atmosphere.

Healthy yam tubers (*Dioscorea alata L.*) were selected as seed materials and were planted in the Botanical garden of Annamalai University. Undamaged, healthy yam tubers were selected after harvest and they were stored in a special storage chamber kept at a constant temperature of 28 ± 2°C and 50-60% humidity.

Dry weight of 10g pieces of fresh tissue was taken at regular intervals after drying the material in an oven at 80°C for 24 hours. Protein content was measured by the method of Lowry *et al*[7]. RNA content was estimated by the method of Smillie and Krotkov[8]. Soluble proteins were extracted by the method of Maraite[9]. 500 mg tuber tissue was homogenised with 1 ml of 0.2M Tris - glycine buffer (pH 8.3) containing 20% sucrose in a glass test tube homogeniser. The homogenate was centrifuged for 15 min at 3000 rpm. The supernatant was used for polyacrylamide disc electrophoresis by

the method of Davis[10]. The chemical formulations adopted for the preparation of gel were that of Canalco Bulletin[11].

The gels were stained in 0.1% amido black in 7% acetic acid for one hour. 7% acetic acid was used for destaining and storing. The gels were scanned at 546 nm in a SCO Model UA-5 absorbance monitor to observe the number and density of the protein fractions.

The dormant period of yam tubers was found to be 56 ± 4 days. There was a total 10% increase in dry weight over the initial weight during the 8 weeks dormant period. The increase was gradual in the initial phase (6% in 6 weeks) and rapid in the final phase (4% in 2 weeks). The protein and RNA contents increased by 100% and 3% respectively over their corresponding initial values in the eight weeks dormant period. The pattern of increase in protein and RNA contents was similar. A rapid increase with a 5 0% increase in protein content and a 1.2% increase in RNA content over the initial values was observed in the last two weeks (Table-1). Electrophoretic profiles of soluble proteins of yam tubers showed three protein fractions in the initial stages which increased to six at the end of the eight weeks dormant period. Among the three new fractions, one appeared on the 5th week, the second on the 7th week and the third fraction just before the end of the dormant period (Fig.1). All the three new bands had mobility values (Rm) within the range of the initial values, i.e. between 2.2 and 4.5.

Dormancy break requires the synthesis of protein and RNA synthesis and it is associated with derepression of the genetic material and synthesis of mRNA[4,12,13].

The quantitative studies of the present experiment showed the rapid increase in dry weight, protein and RNA content only after the 6th week. But the

Table 1. Dry weight, protein and RNA contents of *Dioscorea alata* tubers.

(Values are mean ± SE of 7 samples)

Dormant Period (Weeks)	Dry weight[a]	Protein[b]	RNA[b]
0	28.00 ± 0.22	4.32 ± 0.27	1.34 ± 0.02
1	28.20 ± 0.20	4.43 ± 0.28	1.35 ± 0.02
2	28.60 ± 0.15	4.93 ± 0.32	1.39 ± 0.01
3	29.02 ± 0.24	5.38 ± 0.38	1.44 ± 0.03
4	29.40 ± 0.17	5.63 ± 0.30	1.46 ± 0.02
5	29.70 ± 0.19	6.00 ± 0.34	1.52 ± 0.03
6	29.80 ± 0.15	6.53 ± 0.40	1.58 ± 0.01
7	30.35 ± 0.18	7.54 ± 0.36	1.64 ± 0.03
8	31.00 ± 0.14	8.72 ± 0.32	1.71 ± 0.02

[a]Percentage of total weight; [b]Percentage of dry weight

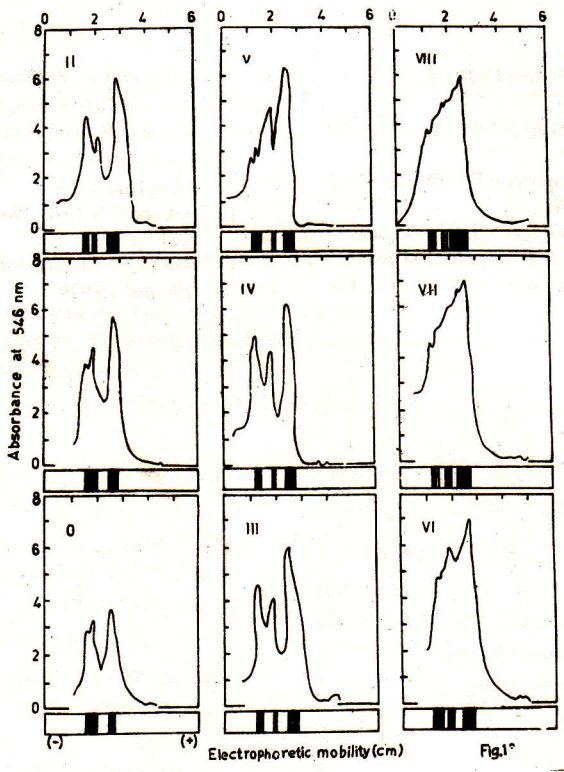

Fig.1. Changes in the electrophoretic profiles of the soluble proteins of the dormant tubers of *Dioscorea alata* scanned at 546 nm.

0-VIII : Weeks after harvesting of the tuber.

appearance of a new band denoting a new protein fraction on the 5th week suggests that the dormancy breaking mechanism has been activated from the 5th week itself. Further, the involvement of proteins of intermediate range molecular weight in dormancy and dormancy break of yams is reported with the mobility values of the protein fractions remaining between 0.22 to 0.45.

Thus from the present study the definite or 'stable dormant' period of dormancy appears to be only 4 weeks after harvest for yams. During the 5th week itself, protein and RNA synthesis is triggered which attain the peak state during the 7th and 8th week of dormancy resulting in spouting.

References

1. Rappaport L and Wolf N 1968, *In:Proc. Int. Symp.Plant Biochem. Reg. Viral and other diseases or injury* Tokyo, Japan, 203-211
2. Wareing P G 1982, *In: The Physiology and Biochemistry of seed development, dormancy. and germination*, Elsevier. Biomedical Press, Oxford, (Ed) A.A.Khan, 185-202
3. Wickham L D, Passam H C and Wilson L A 1984, *J.Agric. Sci. 102* 427

4. Tuan D Y H and Bonner J 1964, *Plant Physiol.*, ***39*** 768
5. Rappaport L and Stahl N 1965, *Am. J. Bot.* ***52*** 623
6. Madison M and Rappaport L 1968, *Plant and Cell Physiol.* ***21*** 147
7. Lowry O H, Rosebrough N J, Farr A L and Randall R J 1951, *J. Biol. Chem.* ***193*** 265
8. Smillie R M and Krotkov G 1960, *Can. J. Bot.* ***38*** 31
9. Maraite H 1978, *Physiol, Plant Pathol.* ***3*** 29
10. Davis B J 1964, *Ann. Ny. Acad. Sci.* ***121*** 404
11. Canalco Bulletin 1968, Canal industrial corporation, 3635, Fisherline, Rockville, Maryland, USA.
12. Okagami N 1978, *Plant and Cell Physiol.* ***19*** 221
13. Jan G, De Klerk and Smulders R 1984, *Plant Physiol.* ***75*** 929