Pak. J. Bot., 14(2): 155-161, 1982.

INFLUENCE OF FLURENOL (MORPHACTIN) ON YIELD, CARBOHYDRATES AND POST HARVEST CHANGES IN POTATO TUBERS

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Abstract

Tuberization and yield of potato *(Solanum tubersoum* L.) cv. 'Kufri Alankar' increased by single foliar spray of flurenol (n-butyl-9-hydroxyfluorene-9-carboxylate) at 25, 50, 100 and 150 ppm but drastically reduced at 200 ppm. Carbohydrate contents in tubers increased at 25,50 and 100 ppm and decreased at 150 and 200 ppm of Flurenol. Flurenol inhibited sprouting of the buds. Loss in weight and rotting of tuber in storage were suppressed by flurenol. Flurenol prevented conversion of starch into sugars and retarded the sweetening of tuber during storage.

Introduction

The morphactins, to which flurenol belongs, are versatile synthetic bioregulants exhibiting a wide spectrum of diverse effects on growth, development and morphogenesis in flowering plants (Schneider, 1970; 1972; 1973; Sankhla et al., 1975; Bisaria 1977a; 1981). Chlorflurenol, one of the most active morphactins examined, has been reported to affect tuberization and crop production (Schneider, 1970; Bisaria, 1977b). Morphactins have been observed to stimulate the synthesis of chlorophylls, carbohydrates and fats (Schneider, 1970; Ziegler, 1970; Sankhla et al., 1975; Bisaria et al., 1979; Jha, 1980; Narang, 1981). Since these compounds exhibit a wide spectrum of morphogenetic influence, the effect of flurenol (morphactin) on the yield attributes and post harvest modification in tuber of potato was examined.

Materials and Methods

Experiments were carried out during winter of 1978 and 1979 from 15th October to 15th February. Seed tuber of potato *(Solanum tuberosum* L.) cv. 'Kufri Alankar' were sown in earthen pots (30 X 25 cm.) containing a mixture of ordinary garden-soil and farm-yard-manure (3 : 1). Each treatment consisted of ten plants and was replicated three times. Four-week-old plants were sprayed once with an aqueous solution of flurenol

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(n-butyl-9-hydroxyfluorene-9-carboxylate E.M.D. IT-7311) at 25, 50, 100, 150, and 200 ppm by an atomizer. Glass distilled water and wetting agent (Tween-20; 0.1%) were used as control. Before spray the pots were covered with thick paper pieces to prevent contamination of soil with flurenol. All the treatments received same cultural practices.

After harvest tubers were graded and yield of tubers per plant in terms of weight was computed. Freshly harvested tubers were washed in running tap water and dried in shade for five hours (10 am – 3 pm). The tubers were then kept at room temperature ranging between 21°C – 38°C (from 15th February to 25th May in 1978 and also in 1979) to elucidate post-havrvest changes during storage. Sprouting of buds, loss in weight of tubers and rotting were determined after 100 days of storage.

The amount of reducing sugar, non-reducing sugar, total sugars and starch were estimated in freshly harvested and stored tubers. Fresh samples (2g) were prepared for estimations. Reducing and total sugars were estimated by Nelson's arsenomolybdate method. Somogyi's (1945) improved copper reagent was used in the estimation and absorbancy was measured at 530 nm. Freshly prepared glucose (B.D.H.) standards were induced with each set of samples. Nonreducing sugars were calculated by substracting the reducing sugar from the total sugar contents. The amount of starch was determined in residue left after estimation of sugars by Anthrone method and absorbancy was measured at 620 nm. The amount of starch was calculated by multiplying the values of glucose by 0.9. Five samples were analysed for each treatment and the data were analysed statistically.

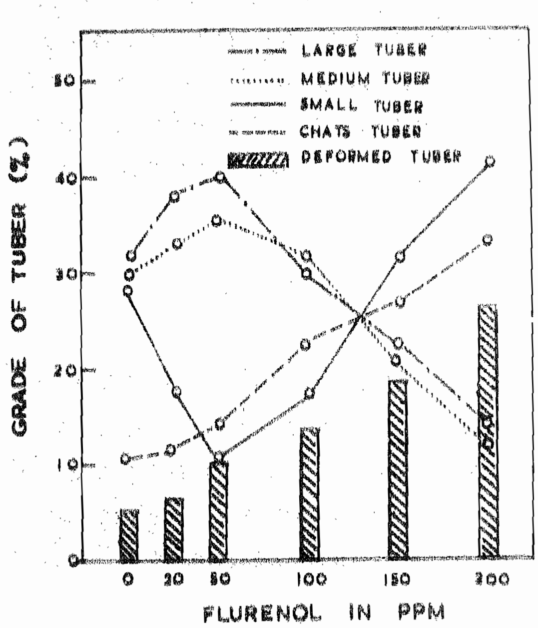

Fig. 1. Effect of Flurenol on grade of tuber potato.

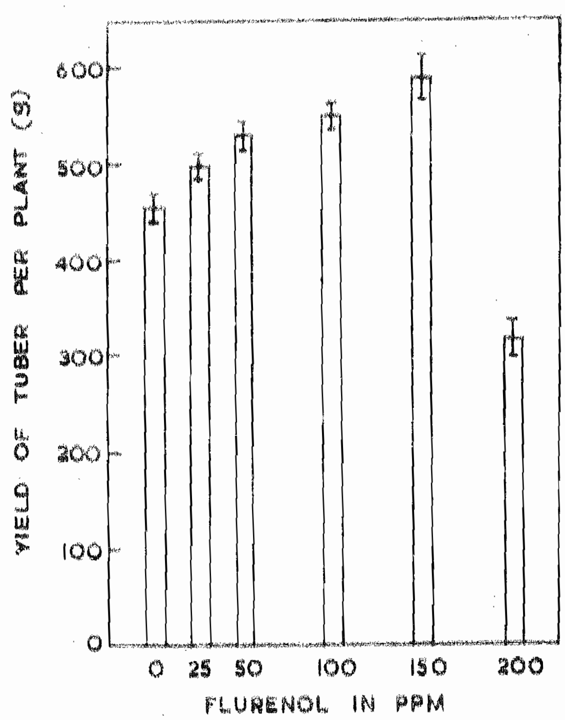

Fig. 2. Effect of flurenol on potato yield.

Results

Foliar application of flurenol upto a concentration of 150 ppm increased tuberization which however drastically reduced at 200 ppm (Fig.1). The production of large and medium sized tuber significantly increased by flurenol at 25, 50 and 100 ppm, and decreased at 150 and 200 ppm (Fig 1). The formation of small tubers was proportional to the concentration of flurenol in *Solanum tuberosum* (Fig.1). Flurenol increased the formation of deformed tubers, abnormal in shape with gradually increasing concentration (Fig. 1). Some of the adventitious roots emerged out of the soil surface in plants applied with flurenol at 100, 150 and 200 ppm. Such roots thus exhibited negative geotropic behaviour.

The exogenous application of flurenol, enhanced the yield of tubers up to a concentration of 150 ppm which however reduced drastically at 200 ppm (Fig.2). Maximum yield of tubers (589.4 g/plant) was observed in plants treated with flurenol at 150 ppm.

Flurenol at 25, 50, 100 and 150 ppm significantly increased the reducing, non-reducing and total sugars but it dcreased in treatments at 200 ppm. A significant increase in starch and total carbohydrates was observed in treatments at 25, 50 and 100 ppm while a marked reduction was noted at 150 and 200 ppm (Fig.4). Flurenol reduced the ratio of starch and sugars at 25, 50 and 100 ppm but increased it at 150 and 200 ppm (Table 2). The maximum increment in ratio of starch and sugars in tubers of potato was observed at 200 ppm (Table 2).

Data presented in Table 1 shows that flurenol reduced the loss in weight of tuber progressively with increasing concentration. The sprouting of buds during storage was

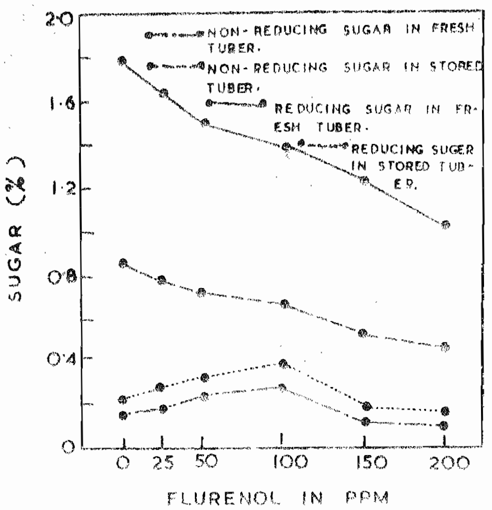

Fig. 3. Effect of flurenol on sugar in potato tuber.

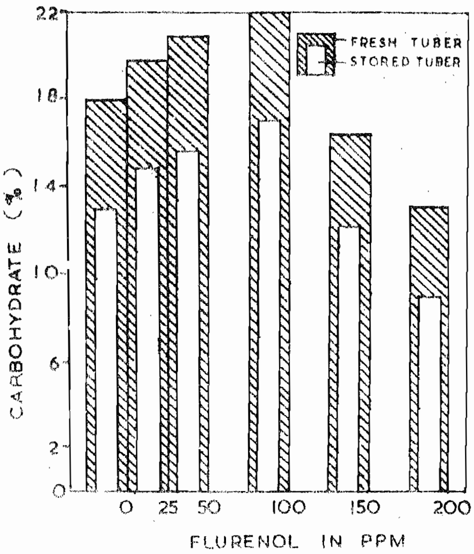

Fig. 4. Effect of flurenol on carbohydrate in potato tuber.

also inhibited and was proportional to the concentration of flurenol. A significant reduction in rotting of tubers was also observed in treated plants (Table 1).

Flurenol significantly increased non-reducing, reducing and total sugars in all the treatments over fresh tubers of treated plants. One of the most striking influence of flurenol was the reduction in total sugars at all concentrations of bioregulant and this reduction was directly proportional to the concentration of flurenol (Table 2). Stored tubers were found to have more starch at 25, 50 and 100 ppm, with less starch at 150 and 200 ppm (Fig-4). Flurenol reduced the ratio of starch and total sugars upto a concentration of 100 ppm and increased at 150 and 200 ppm in stored potato tubers (Table 2).

Discussion

The present observations on the increase in tuberization in potato are in accordance with those reported earlier (Merck, 1970; Schneider & Mohr, 1970; Bisaria & Sharma, 1975). Flurenol accelerated the production of small and deformed tubers. Since the deformed tubers belong to the groups of large and medium tubers therefore they did not reduce the yield. The observations that flurenol increased the yield of tuber in potato are in agreement with those reported for many tuberous-crops (Schneider, 1970; Schneider & Mohr, 1970; Bisaria, 1977b).

Morphactin (flurenol) increased sugar and starch contents in patato tuber. The results are similar to those reported for *Prunus persica* (Stancovic et al., 1968), *Cardemine*

Table 1. Effect of flurenol on post-harvest qualities of potato tuber cv. Kufri Alankar

Flurenol ppm	Loss in weight (%)	Sprouting of buds (%)	Rotting of tuber (%)
0 (Control)	20.3±0.62	36.9±0.81	24.7±0.37
25	17.6±0.57	34.7±0.68	19.3±0.44
50	16.9±0.73	30.6±0.76	16.2±0.21
100	12.3±0.41	25.3±0.59	14.8±0.29
150	10.7±0.24	17.4±0.32	9.2±0.20
200	7.9±0.21	11.2±0.16	6.5±0.11
C.D. at P=0.05 for comparison with control	1.35	2.74	1.29

Table. 2 Effect of flurenol on total sugars, total carbohydrate and ratio of starch/sugars in potato tubers cv. Kufri Alankar (Values are g/100g of sample)

Flurenol ppm	Total Sugars		Starch		Starch : Sugar	
	A	B	A	B	A	B
0 (Control)	0.39	2.90	18.10	12.94	46.4:1	4.4:1
25	0.47	2.42	19.80	15.16	42.1:1	6.2:1
50	0.58	2.24	20.57	17.80	35.6:1	7.0:1
100	0.66	2.07	21.40	17.20	33.1:1	8.3:1
150	0.31	1.75	16.50	12.10	53.2:1	6.9:1
200	0.22	1.52	13.18	9.91	59.9:1	6.5:1
C.D. at P=0.05 for comparison with control	0.10	0.37	1.52	1.17	–	–

A Fresh tuber
B Stored tuber

chenopodifolia (Lorenzen & Wiesbrich, 1969), *Zea mays* (Bisaria et al., 1979) and *Abelmoschus esculentus* (Narang, 1981). In contrast, Morphactin (chlorflurenol) has been reported to reduce the sugars in *Beta vulgaris* and *Sacharum officinarum* (Merck, 1967).

Flurenol is known to disturb auxin translocation and distribution (Parpus, 1970; Naqvi, 1972; Chang, 1975) and to stimulate ethylene synthesis in plant systems (Schneider, 1972; Khan et al., 1975). The increased yield of tubers is probably due to the effects on auxin translocation, ethylene synthesis with weakened apical dominace, profused branching, accelerated tuberization and higher yield in potato. The increase in sugar and starch contents in potato tuber by flurenol (morphactin) as has been reported for other crops also (Stancovic, 1969; Bisaria & Sharma, 1975; Bisaria et al., 1979) is possibly due to accelerated photosynthetic efficacy and translocation of photosynthates to tubers. The experimental results would suggest that flurenol is a potentially useful synthetic bioregulant for improving tuberization, yield and carbohydrates and for retarding sprouting, loss in weight and sweetening of tubers.

Acknowledgements

The gift of flurenol from Dr. G. Schneider, Celamerck-6507, Ingelheim Rhein, West Germany is gratefully acknowledged. Thanks are due to Dr. R.N. Gupta, Principal, Hindu College, Moradabad for laboratory facilities and to Dr. Mrs. Ranjana Narang for her pleotropic assistance.

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