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SHORT REPORTS

EFFECT OF 1-AMINO-4-SULPHONATE-β-NAPHTHOL ON THE OIL CONTENT AND FATTY ACID COMPOSITION OF PEANUT

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Key Word Index—*Arachis hypogaea*; Leguminosae; peanut; oil; fatty acids; 1-amino-4-sulphonate-β-naphthol.

Abstract—Exogenously applied 1-amino-4-sulphonate-β-naphthol increased the oil content and altered the fatty acid composition of the semispreading variety C-501 of peanut. The content of oleic acid decreased while that of linoleic acid increased in the kernels of treated plants.

INTRODUCTION

The quality of a vegetable oil is largely determined by its fatty acid composition. The varietal differences in fatty acid composition are usually attributed to genetic factors [1, 2]. Variable breeding techniques are now being employed to manipulate the composition of oil. The general modifications of the chemical components of protein and oil of peanut have not been extensively researched. In peanut, growth regulators in general [3, 4] and phenolic compounds in particular [5, 6] have been shown to be highly effective in regulating the number of flowers, pods, yield, oil content, etc. The present paper reports the effect of 1-amino-4-sulphonate-β-naphthol (1,2,4-acid) on the oil content and fatty acid composition of one semispreading peanut variety, C-501.

RESULTS AND DISCUSSION

The data given in Table 1 show significant differences between the control and 1,2,4-acid treatment with regard to number of gynophores, number of pods per plant and yield per hectare. However, there were no significant differences with regard to shelling percentage. Significant differences between the control and 1,2,4-acid treatment were also noticed with regard to oil content.

The data in Table 2 pertain to fatty acid composition. 1,2,4-Acid caused alterations to the unsaturated fatty acids. Amongst these, oleic acid (18:1) decreased while linoleic acid (18:2) increased. Both in the control and treated plants, 18:1 constituted the major fatty acid component.

The present investigation shows that exogenous applications of 1,2,4-acid increase the number of gynophores per plant. The increase in gynophores could be attributed to enhanced pollen germination and tube growth and to an increase in the number of fertilized flowers. The phenolic acid treatment also increased the number of pods per plant and yield per hectare. Fertilization and peg formation are reportedly poor in peanut [7] and the phenolic treatment enhanced fertilization potential, followed by increased mobilization of photosynthate towards developing gynophores. Similar observations were made by Malik *et al.* [6] in other varieties of peanut. 1,2,4-Acid treatment also enhanced the oil content which may again be attributed to increased mobilization of photosynthates.

It is of special interest to note that the concentration of 18:2 increased while that of 18:1 decreased in plants sprayed with 1,2,4-acid. Thus, the relative concentrations of the major fatty acids, 18:1 and 18:2, were altered. It would appear that 1,2,4-acid stimulated the conversion of 18:1 to 18:2 by enhancing the desaturase enzyme. In general, plants with low 18:1 and high 18:2 contents are preferred because their oil is nutritionally superior [8]. It appears that phenolics can be used beneficially in peanut to increase the oil content and also to alter their fatty acid composition. Thus, an oil with a high proportion of 18:2 can be obtained. There is an enhanced demand for the consumption of refined oil and it is preferred over hydrogenated oil.

1,2,4-Acid is a monophenol and it was highly effective in modifying several physiological and biochemical characteristics associated with yield. Hess [9] proposed that the occurrence of two hydroxyl groups at the *ortho* position with a free *para* position was essential for the biological activity of a phenolic compound. The studies of Pilet [10] also indicated that monophenols inhibited growth and differentiation whereas di- and polyphenols were stimulatory. Our studies do not support their contention. Clearly, the present investigation demonstrates that phenolic acids can be utilized to enhance peanut oil yield and to improve its oil quality.

Table 1. Effect of 1,2,4-acid on yield, oil contents and shelling percentage of peanut var. C-501

Treatment	No. of gynophores/ plant		No. of pods/ plant		Shelling %		Yield (kg/ha)		% increase over control		Oil %		Total oil yield*	
	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985	1984	1985
Control (distilled water)	122	134	17	21	65	68	2070	2100	—	—	47.4	47.8	98118	100380
1,2,4-Acid (100 ppm)	149	164	28	31	67.5	71	2268	2315	9.5	10.2	47.4	48.6	107503	112509
(200 ppm)	157	169	28	33	71.3	70.6	2268	2310	9.5	10	49.8	50.8	112946	117348
CD at $P = 0.05$	18.3	12.7	4.11	5.2	n.s.	n.s.	142.7	137.7	—		2.3	2.6		

*Total oil yield = yield (kg/ha) × oil %.
n.s., Non-significant.

Table 2. Fatty acid composition in peanut variety C-501 as affected by treatment with 1,2,4-acid (200 ppm)

Treatment	Oil %	Acid composition %						
		16:0	18:0	18:1	18:2	20:1	22:0	24:0
Control	47.0	11.44	2.12	58.26	23.44	0.50	1.18	3.08
1,2,4-Acid	49.0	11.13	2.52	47.36	32.80	0.74	1.64	3.80

EXPERIMENTAL

Seeds of the peanut variety C-501 (*Arachis hypogaea* L.), obtained from the Department of Plant Breeding, Punjab Agricultural University, Ludhiana, were sown in the field during 1984, with three replications of each treatment having a plot size of 4.5 and 3 m.

The crop was raised according to the recommended practices for fertilizers, irrigation and plant protection measures (Packages of Practices, 1982, PAU, Ludhiana). A soln of 1,2,4-acid was prepared by dissolving it in a few drops of EtOH and then the final vol. was adjusted with H_2O. Two sprays were given 35 and 50 days after sowing at 100 and 200 ppm concns. Controls comprised spraying with H_2O alone. Experimental plots were sprayed with a foot-sprayer at 500 l. of soln per hectare. Five plants were selected from each plot at the time of harvesting for recording the data on the number of pods per plant and evaluating yield.

Oil in the kernels was determined by the method of ref. [11] and verified by NMR. Fatty acid Me esters were prepared by the method of ref. [12] and analysed by GC in the 200 ppm treatments only. An FID instrument was used with a glass column (6 mm × 2 m) packed with 1% diethylene glycol succinate. GC was carried out at 190° with a gas flow rate of 60 ml/min. The various fatty acids were identified from the R_f values and their peak areas were directly converted into relative percentages with the aid of a data processor.

The data given in Table 1 are from a 1984 expt and a 1985 crop gave a similar result. The data given in Table 2 are from a 1984 expt and values are from one analysis.

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