RESPONSE OF CORIANDER TO THE MODE OF PHOSPHORUS APPLICATION

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ABSTRACT

Three modes of phosphorus application, partly or fully through the soil or foliage, were conducted to evaluate the effect of P application mode on green and fruit yields were of coriander and their chemical constituents.

The highest values in plant height, green and dry matter production as well as fruit yield, were recorded when P was given partly through soil and foliage Generally, the three methods of P application increased carbohydrate and protein concentrations in shoots and fruits as compared to the control, in the two seasons in both cuts. The addition of P partly through soil increased the volatile oils concentration of shoots and fruits in the two cuts in both seasons, over the all treatments. The identification of volatile ails in shoots and fruits varied according to the mode of P application.

Introduction

Coriander, *Coriandrum sativum* L., Family Umbelliferae is one of the most flavouring and medicinal oil crops. It is used as flavouring agent, carminative, stimulant and sedative (Wallis, 1967).

Phosphorus plays an important role in plant life and is considered as an indispensable element for several vital functions. It plays a role in fruits formation, as well as ripening, carbohydrates transformations, protein synthesis and it is a constituent of lipoids (Hewitt and Smith, 1975).

From the macro-nutrient elements, phosphorus should perhaps offer the most promise as a foliar applied fertilizer. The quantitative needs for phosphorus are not as great as those for most other major elements. Without phosphorus additions, cultivated soils will usually become deficient, and when phosphate fertilizers are applied, a large percentage usually reverts to, or becomes fixed in forms unavailable to growing crops. Phosphorus, of all soil constituents, is the one for which agronomists of different countries express the greatest fear of ultimate exhaustion (Browne, 1939). Large quantities, very little of which are recoverable, are presently being utilized a fer-

The parsley fruits of commercial regional variety, in the rate of 10 kg/feddan, were mixed with sand and broad-coasted by hand in plots of 2 x 2.5 m. Planting took place on November 11 and 13 in 1981 and 1982, respectively. Calcium superphosphate (15.5% P2O5) was added at ploughing time with the rate of 100 kg/fed, while 50 kg ammonium nitrate (33.5% N) per fed. was added after every cut. Other normal cultural practices of growing parsley was followed.

Five cuts were taken, the first after two months from sowing time and the other cuts at one month intervals. The plant height in cm, fresh and dry weights in gm/plant were determined every two weeks after 30 days from sowing time. Fresh weight in gm/plant was recorded at every cut. Oil yield and its constituents, carbohydrates and proteins were determined after 30 days from sowing at two weeks intervals in shoots on moisture free basis according to the standard method outlined by Karowya *et al,* 1980, Balbao, 1976 and Weichselgram, 1946 respectively

The essential oils were prepared by solvent extraction and were analysed qualitatively and quantitatively by GLC (Karowya *et al,* 1980), using Varian 3700 dual flame ionization detector using the following column: Coiled glass 6 feet in length, 1/4 inch internal diameter, packed with 20% PBGA on chromosorb W 60-80 mesh, temp. 180-190°C, injection part temp. 220^{o}C, detector temp. 300^{o}C, carrier gas (He) flow rate 20 ml/min., air flow rate 200 ml/min and chart speed 1 cm/min. Data was analysed statistically according to Snedecur *et. al,* 1969 procedure.

Result and Discussion

The calculated value (average of the two seasons) of the plant height, fresh and dry weights per plant were graphically illustrated in figure 1 (A, B and C, respectively).

The highest plants were showed in the 4th cut (150 days old), while the fresh and dry weights of the third cut (120 days old plane recorded the highest results.

Data obtained on fresh weight of parsley plants/plot were shown in Table-1. Highest fresh weight was observed in the 3rd cut, whereas lowest occurred in late summer cut (5th cut) in both seasons. This effect is presumably due to suitable climatic conditions for growth in 3rd cut (during March and April) than those in case of other cuts, especially June cut (5th cut).

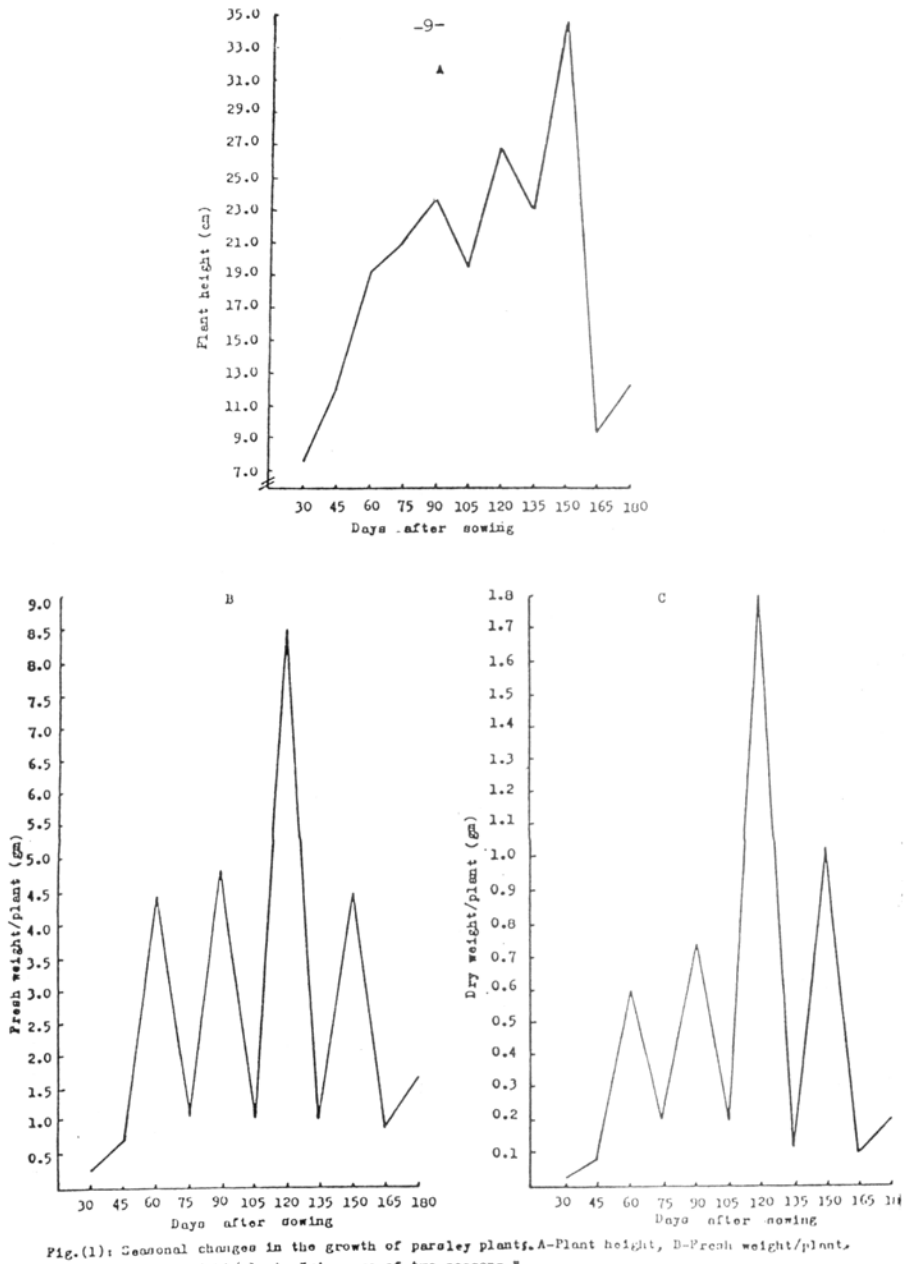

Fig.(1): Seasonal changes in the growth of parsley plants. A-Plant height, B-Fresh weight/plant, C- Dry weight/plant. " Average of two seasons ".

TABLE-1

Green matter production/plot of parsley as affected with duration in both seasons

No. of Cuts	Fresh Weight/plot (kg.)	
	1981-1982	1982-1983
1st cut	2.09	3.14
2nd cut	2.99	3.92
3rd cut	3.81	4.62
4th cut	3.19	3.59
5th cut	0.47	0.51
L.S.D. 5%	2.09	1.72
L.S.D. 1%	2.85	2.30

TABLE-2

Changes in Chemical constituent of parsley shoot system with relation to plant age (average of two seasons)

Days After Sowing	Protein %	Charbohydrate* %	Vol. Oil %
30	0.34	1.40	0.50
45	0.80	1.13	0.87
60 (1st cut)	0.79	1.30	1.92
75	0.50	0.90	1.03
90 (2nd cut)	0.23	1.46	1.24
105	1.56	1.16	0.84
120 (3rd cut)	1.10	1.18	2.89
135	2.20	1.70	2.15
150 (4th cut)	1.84	2.36	1.83
165	1.63	1.65	1.54
180 (5th cut)	1.22	0.84	0.96
L.S.D. 5%	0.61	0.42	0.67

*Carbohydrates were calculated as soluble carbohydrates.

The dietic value of parsley as a source of proteins and carbohydrates as well as the essential oils was calculated and tabulated in Tables 2. Regarding proteins, their value was increased drastically after the second cut, reaching its maximum at 135 days from sowing time. The highest percent of carbohydrates was attained in the 4th cut (150 days old plants). Concerning the volatile oil concentration, Table-2 shows a high percentage in the first cut which may be attributed to the longest time of the plant spent in the soil (60 days). The second cut was taken after 30 days from the first one, so the volatile oil percentage decreased. It is of importance to point out that the volatile oil percent increased in the third cut not only in comparison to the second, but also to the first cut. This result may be attributed to the climatic condition suitability for 3rd cut. The oil yield in the 4th cut decreased than in the 3rd but was still higher than in the 2nd. The fifth cut showed the lowest result regarding the volatile oil content.

Comparing the three constituents (proteins, carbohydrates and essential oils), Table-2 show that the increase in carbohydrates usually associated with a decrease in essential oils and proteins percent. This result was in agreement with that reported by Britto *et. al.,* 1965 and Butterworth *et. al.,* 1965.

Table-3, for the GLC analysis of the volatile oil samples, showed the following:

1. The parsley plants contain high percentage of hydrocarbons than other compounds for all samples under test. Those hydrocarbons specially the a-pincne and terpinene were concentrated in the plants of 60 and 180 days old (60 days for apincne and 180 days for terpinene).

2. The oxygenated components of the volatile oil of parsley specially the ketones are the next after the hydrocarbons regarding their concentration dihydrojasmone was the pioneer one and its maximum concentration was observed in the plants of O days after sowing.

   Some of the alcoholic components were observed in the earlier stages of growth viz., linalol, farnesol and geranol while some of the alcoholic components were detected in the last stages such as terpeneol and citronella].

   The phenolic components specially O-cresol, eugenol, thymol and carvacrol were alternating with each others in their presentation during the plant life.

   Compounds containing oxides and aldehydes were observed in the earlier stages but were absent in the latter stages.

   Regarding the ester components they were observed. Linalyl acetate and methyl anthranilate were alternating in these results.

Table (3) : Volatile oil components and identification for parsely shoots during the growth period (average of the two seasons).

Peak No.	Relative retention time	Identification	Percentage of the components of plants cut. (Days after sowing)										
			30	45	60	75	90	105	120	135	150	165	180
1	0.04	unknown	-	-	-	-	-	-	0.6	-	-	-	-
2	0.12	∝-pinene	3.6	17.3	24.6	15.2	11.0	8.5	10.5	20	19	21	25
3	0.23	Cineol	-	-	-	-	-	12.6	-	-	-	-	-
4	0.27	Myrcene	-	-	6	-	-	-	-	-	-	-	-
5	0.3	Terpinene	15.2	2.3	7	3.6	10.4	-	-	22.0	20	21.9	30
6	0.4	Terpinolene	4.8	3.8	4	4.8	14.3	-	4.0	-	8	5	11
7	0.58	Methyl heptenone	8.7	-	4	-	-	-	14.5	-	-	-	-
8	0.64	Aldehyde C_7	-	5.3	-	6.5	2.7	-	-	-	-	-	-
9	0.72	Unknown	6.1	9	6.5	-	-	-	2.6	-	15	-	-
10	0.82	Benzaldehyde	-	-	-	8.9	-	-	-	-	-	-	-
11	1.00	Linalol	9.1	-	10.0	-	3.4	4.2	17.1	-	-	-	-
12	1.10	Linalyl acetate	-	9.8	-	6	-	2.1	4.4	-	-	-	-
13	1.28	Methyl benzoate	-	-	-	-	5.2	3.8	-	-	-	-	-
14	1.41	Terpineol	-	-	3.0	-	-	-	-	19	11	14	17
15	1.42	Citral	6.1	-	-	-	-	-	-	-	-	-	-
16	1.51	Piperitone	-	7.7	-	6.5	-	-	-	-	-	-	-
17	1.63	Benzyl acetate	-	-	-	-	-	-	5.3	-	-	-	-
18	1.65	Methyl salicylate	-	-	6	-	-	-	-	-	-	-	-
19	1.7	Citronellol	-	-	-	-	-	-	-	-	15	24	8
20	1.81	Geraniol	-	-	6.7	-	-	12.6	-	17	-	-	-
21	1.98	O-cresol	10.3	14.3	-	18.7	-	-	-	-	-	-	-
22	2.00	Jasmone	-	-	-	-	9.2	-	-	-	-	-	-
23	2.05	∝-Ionone	-	-	-	-	0.2	-	-	-	-	-	-
24	2.12	Methyl anthranilate	-	-	-	-	-	3.5	-	-	-	7.1	6.3
25	2.23	Farnesol	-	-	3	-	2.7	-	-	9.3	4.9	-	-
26	2.47	Eugenol	-	-	-	-	-	6.3	-	-	-	3.4	-
27	2.50	Thymol	-	-	-	-	-	-	5.7	5.6	-	-	-
28	2.55	Carvacrol	-	9.0	-	6.3	-	-	-	-	-	-	-
29	2.96	Dihydrojasmone	9.7	10.8	18	9.7	-	8.1	9.6	-	-	-	-
30	3.30	Indole	-	-	-	-	6.2	-	14.0	-	-	-	-
31	3.51	Skatol	22.4	19.5	2.1	2.4	9.9	15.3	-	-	-	-	-
32	4.20	Unknown	-	4	-	5	3.46	14.0	3.5	-	-	-	-
33	5.00	Phenyl acetic acid	4.2	-	1.6	-	6	5.5	3.5	-	-	-	-

3. The nitrogenous components were also present in various concentrations in the earlier stages specially skatol.

From the above mentioned results it was clear that the cutting lime parsley plants had a great effect on the plant yield, and its chemical coma ducats. The present data has proved that the 3rd and 4th cuts, dated during the months of March and April provided the highest green yield as well as essential oil percent with best qualities under the experimental conditions.

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