

STUDIES ON GROWTH AND CHEMICAL CONSTITUENTS OF PARSLEY PLANTS IN RELATION TO ONTOGENESIS

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Eleven parsley plant samples were collected periodically every two weeks after 30 days from sowing time. The collected samples were chemically analysed in order to determine their dietic and medicinal values. The 120 days old sample contains the highest percentage of essential oils. The qualitative and quantitative analysis of the essential oils were performed by GLC. Five cuts were taken to determine the growth changes and yield. The highest yield was detected in the 3rd cut (120 days old plants).

Parsley, *Petroselinum sativum* Hoffm., is one of the most widely used umbelliferous plants. The essential oils of both herbs and fruits are of wide application in food production and medicinal preparations (Muroveora, 1978). The herb is used for flavouring and granishing of meat fish and some vegetables (Osman, 1952). Parsley fruits are utilized in folkore medicine as emmenagogue, in amenorrhea and dysmenorrhea as well as stimulant galactagogue and as a bortificent (Muroveora, 1978). Several chemical compounds were isolated or identified in parsley viz, carotenes (French and Abbot, 1948), vitamins (Dilys et. al, 1952 & Petosini, 1949), fatty acids (Soro et. al, 1960), proteins and coumarins (Rodighiero and Allegri, 1959). The essential oils were identified qualitatively and quantitatively by GLC (Franz and Clasl, 1974). The composition of the plants changes more or less with the progress towards maturity.

The present work include the change in growth and chemical analysis of parsley plants during plantation period to identify the better cuts for green yield and medicinal preparations.

Material and Methods

Two experiments were carried out in the Faculty of Agriculture experimental farm at Kafr EI-Sheikh, Tanta University, during 1981/1982 and 1982/1983 seasons. The experimental locations were clay loam in texture with pH 8.1. Randomized complete block design with four replicates, and each replicate obtained four plots, were used.

Unlike many other plant nutrients, phosphate fertilizer in the soil may not move appreciably from the area of placement. Although present, it may be positionally unavailable. Consequently, it is frequently difficult without mechanical injury of growing crops to effectively sidedress with phosphorus. During recent years, the practice of applying fertilizer solutions directly to the foliage of agricultural plants has received increasing attention.

The present study was conducted to evaluate the effect of phosphorous when applied fully or partly, through foliage or soil, on coriander green plant and ripe fruit yields in addition to their chemical constituents.

Material and Methods

The experiment was done in the Experimental Farm of the Faculty of Agriculture at Kafr El-Sheikh. The type of the soil was clay loam in texture, and the chemical analysis was as follows in ppm.

Year	N	P	K	Zn	Mn	Fe	Cu	pH
1981	22.0	15.0	280.0	1.2	3.8	10.2	9.4	8.2
1982	19.7	16.9	290.0	1.4	4.0	10.0	8.5	8.3

The experiment was designed as complete randomized blocks with six replicates for each treatment.

The coriander fruits Var. Balady were broadcasted by hand in plots 3 x 4 m on November 7th 1981 and 9th 1982.

Ammonium sulphate (20.6% N) at the rate of 200 kg/ha and potassium sulphate (48.5% K₂O at the rate of 50kg/ha) were added to the soil at 2 equal portions; the 1st addition was just before the first irrigation (after three days from sowing), whereas the 2nd was after the first cut directly.

The experiment included three modes of P application, i.e. full dose through soil, 1/2 of the dose through soil + 1/2 of the dose through foliage and fully through foliage as well as the control where P was not applied. Phosphorus was added as calcium superphosphate (15.51% P₂O₅) at the rate of 200 kg/ha. The time of the first treatment, P soil application was similar to N and K. In the second treatment, whereas spraying was done at three dates, the first was after one month from sowing, while the second and third were after two weeks from the 1st and 2nd cuts, respectively. One third of the total amount of P was sprayed in every date at the concentration of 9.3 gm P₂O₅/litre; spraying was done with the help of a hand sprayer. In the third treatment part soil and foliar 1/2 of the dose was used as the first treatment while the other 1/2 was used as the second treatment.

Two cuts were taken, the first was after two months from sowing and the second was after one month from the first one, then the plants were left for fruit production.

In each cut, plant height (cm), fresh and dry weights (g/plant), green yield (Kg/plot) were estimated. Volatile oils were identified and determined in the aerial parts. At maturity, the fruit yield (g/plant and g/m²), fruit essential oils, carbohydrate and proteins were determined. For the chemical analysis, dry plants were used. Weichselgram (1946) and Balbaa (1976) procedures were applied for the analysis of proteins and carbohydrates, respectively. The volatile oils, prepared by solvent extraction, were analysed by GLC using Karawya et. al. (1980) method for the identification. The analysis was conducted using Varian 3700 dual flame ionization detector, D.T. 300°C, injector temp. 220°C, column tern. 180- 190°C, column package 20% PEGA on chromosorb W 60- 80 mesh, column length 6 feet with internal diameter 1/4 inch, carrier gas (He) flow rate 20 ml/min, air flow rate 200 ml/min and chart speed 1 cm/min.

The data were analysed statistically according to the procedure of Snedecor and Cochran (1976).

Results And Discussion

Plant Height

In the two cuts of both seasons the part addition of P through soil and foliage resulted in a significant increase in the plant height as compared to the control (Table-1). On the other hand, the full addition of P through soil or foliage insignificantly in-creased plant height over the control plants in both seasons.

As regards the effect of P application method on plant growth, Wittwer and Lundahl (1951) indicated that favourable growth response was obtained with some P compounds as a foliar spray to vegetable crops. Abdulgalil et. al (1979) reported that the addition of P through soil increased N uptake and thereby the plant growth increased. They added that this trend was not true when P was given fully through foliage.

Green and dry matter production (Herb yield)

It is evident from Table-1 that the three methods of P application increased fresh and dry weights/plant as well as fresh weight/plot; in the two cuts in both seasons, compared with the control. The present results strengthen the view that P application either fully or partly through soil was much effective than its addition fully through foliage, where the increase over control in the last method did not reach the level of significance. The highest value in green and dry matter production was recorded when P was given partly through soil and foliage.

In this connection, Lecat (1952) indicated that the uptake of P by foliage were equal, and in many cases far superior in degree, to that by the root system. On the other hand, Boguslawski (1957) suggested that foliar spray could not substitute for soil application of fertilizers but might be useful in counteracting fixation of nutrients such as P and K. Geissler (1959) stated that optimum utilization of nutrients by the leaves occurred where 25% N and 75% P of the total requirements were applied to the foliage in vegetable plants. Ivangy (1959) found that spraying maize with NPK in-creased water consumption, accumulation of dry matter, transpiration rate, total leaf surface and rate of photosynthesis.

From the present results and the previous literature, it is evident that P application partly through soil and foliage was much effective than its addition fully through foliage or soil.

Fruit yield

Under present study, it is obvious that application of P fully or partly through soil increased significantly the fruit yield per plant and per square meter over the control in both seasons. When P was applied through soil and foliage, this method of application was superior to the usual mode of application through soil. This increase in fruit yield was attributed to the role of P in fruits formation and ripening (Table-2).

In this respect, Yakovlev *et. al* (1975) reported that the foliar application at the milk ripe stage of a nutrient solution containing N and P accelerated translocation of metabolites from leaves to grain of rice.

Chemical constituents of shoot

In the two seasons in both cuts, the three methods of P application increased significantly carbohydrates concentration as compared to the control (Table-3).

Considering the effect of P application mode of proteins concentration in shoot system, the present results in Table-3 indicate that in the first season, compared to the control, the three methods of P application were more effective except the part foliar application in the first cut, where the increase over control did not reach the level of significance. In the second season, only the application of P fully through foliage in-creased significantly the proteins percent in the two cuts.

From Table-3 it is obvious that the full or part addition of P through soil increased significantly the volatile oils concentration in the two cuts in both seasons over the control. The part application of P through soil and foliage was most effective than soil application, in this respect.

TABLE-2
Fruit yield of coriander as influenced by mode of P application

Variable	Method of phosphorus application								L.S.D. 5%	
	First cut				Second cut					
	Control	F	1/2F +1/2S	S	Control	F	1/2F +1/2S	S		
Fruit yield/plant (g)	2.1	2.5	3.6	3.4	1.1	1.9	2.5	3.9	3.1	0.9
Fruit yield/m ² (g)	187.9	256.2	359.2	332.2	134.1	177.8	241.7	385.9	297.0	118.4

F = Foliar application. S = Soil application.

Concerning these physiological changes, Fuleki and Nagymihaly (1956) on maize and Mosolov et al (1956) on wheat, found that the NPK sprays increased carbohydrates and proteins in plants.

Chemical constituents of yielded fruits

In the two seasons, phosphorus through the three methods of application increased significantly carbohydrates concentration in coriander fruits as compared to the control (Table-4).

It is evident that the foliar application of P was effective to increase proteins per-cent in coriander fruits than the part or full addition through soil, and this trend was true in both seasons (Table-4).

In both seasons, addition of P through soil foliage increased significantly the volatile oils concentration in coriander fruits over control and full foliar application, while the increase over the full addition through soil did not reach the level of significance (Table-4).

GLC analysis of the volatile oils was tabulated in Table-5, which showed the following components:

A. Volatile Oil Components of the Aerial Part

1. Ketonic components were observed in both cuts and seasons; α -ionone and dihydrojasnone showed higher results in the First cut specially in the control and soil application for the latter and in the soil and foliar application for the former. Piperitone was also observed at lower percentage than the above mentioned ketones.
2. Oxides were observed in the second cut in all treatments.
3. Esters, specially benzyl acetate and neryl acetate were observed in first and second cuts, respectively.
4. Aldehydes showed higher values in the second cut. Undecyl aldehyde was superior in this respect and showed higher value in the soil application.
5. Alcohols as linalol demonstrated higher values in the second cut of part-soil application.
6. Phenolic components were observed in both cuts and seasons.

B. Volatile Oil Components in the Fruits

1. Camphene β -pinene and myrcene hydrocarbons were observed in the two seasons a pinene was the pioneer in this respect and showed higher result in the foliar application
2. Phenols, specially eugenol showed higher result in the part soil application.

3. Alcohols, specially linalol and farnesol, showed higher values in the part-soil application.
4. Aldehydes specially benzaldehyde was higher in the control samples.
5. Ketones specially the dihydrojasmonone was concentrated in the soil and part-soil application.
6. Esters such as methyl benzoate and benzyl acetate were observed in the investigated samples; the former showed higher results in the foliar application, while the latter showed higher results in the control samples.
7. The investigated samples showed traces of oxides.

In general it can be concluded that, the mode of phosphorus application was greatly affecting coriander green and fruit yield and their active constituents. However, the application of P partly through soil and foliage shows higher values than the other modes under our experimental conditions.

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