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EFFECT OF SOWING DATE ON GROWTH AND ALKALOID PRODUCTION OF *PANCRATIUM MARITIMUM* L.

E.A. EL-GAMAL , ABD-EL-FATTAH M. EL-ZAHWEY AND M. HARIDY

Horticulatural Research Institute, Agricultural Research Centre , Giza, Egypt.

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Abstract

The effect of sowing dates on *Pancratium maritimum* l. was studied at the experimental farm of Medicinal and Aromatic Plants Research Section in El Kanater El Khairia, Kalubia governorate Egypt during 1988 and 1989 seasons. The sowing dates were September 19th, October 19th and November 19th In 1989 one additional sowing date (September 4th) was added.

The results showed that, sowing Pancratium early in September was better than sowing lately in October or November, when the fresh weight of the whole bulbs, the fresh and dry weights of the different parts of the plant and the alkaloid percentage and yield were considered.

The results emphasized also that, August was found to be the best time for harvesting this plant.

It could be recommended that, the best times for sowing and harvesting Pancratium were the beginning of September and August respectively.

INTRODUCTION

The genus Pancratium is a herbaceous perennial plant belongs to family Amaryllidaceae (Bailey, 1960). It is represented through the world in many temperature and warm temperate regions, rare in tropic regions.

In Egypt the genus Pancratium is represented by (Vivi, 1974):

1. *Pancratium maritimum* L.
2. *Pancratium sickenberg*: Asch et. Schweinf ex, Boiss.
3. *Pancratium arabicum* sick.
4. *Pancratium tortuosum Herb.*
5. *Pancratium illyricum* L.

The first four species are widely grown in Egypt, while the fifth is a cultivated one.

Mahmoud (1983) isolated four alkaloids from *Pancratium maritimum* mainly hippadine, tazettine, pancracine and lycorine. He added that, lycorine and tazettine affect blood pressure and lycorine alkaloid increase respiratory rate and affect heart rate.

The effect of sowing date on the growth, yield and active principles of some medicinal and aromatic plants were studied, Hornok (1974), found that, the most suitable time for sowing dill plants was the early date i.e. between 15 and 20 March. While later sowing reduced herbage, fruits and essential oil yields. Mani and Sampath (1982) concluded that, time of planting is one of the important factors affecting the foliage yield and glycoside content of *Digitalis lanata* plants. Singh *et al.* (1987) found that, planting *Mentha arvensis* l. before or after the suitable date resulted in 11-34% reduction in herb yield and 10-31% reduction in oil yield.

Also, El Gamal *et al.* (1990) obtained the highest yield of both herb and alkaloid yield when harmal plant was sown early in September.

The aim of this research was to study the effect of sowing date on growth and the active ingredient of *Pancratium maritimum* l.

MATERIALS AND METHODS

This study was conducted during two successive seasons 1988-1989 in the experimental farm of the Medicinal and Aromatic Plants Research Section in El Ka-

nater El Khairia Egypt.

Bulbils were obtained from the western region of the Mediterranean sea coast at Borg El Arab. Bulbils were sown in one side of the ridges 60 cm apart and 20 cm in between. The experimental unit area was 1.5 m^2 containing 12 bulbils and 2.25 m2 containing 18 bulbils in 1988 and 1989 respectively. Three studied sowing dates mainly September 19th, October 19th and November 19th were carried out in 1988 season. In 1989, one additional sowing date (September, 4th) was used in addition to the three former ones.

Fertilization, irrigation and other agricultural practices were carried out as usual in the two seasons.

Data were taken in three sampling dates in May, June and August. The fresh weight of the whole bulb and fresh and dry weights of the different parts of the plant i.e. leaves, bulbs and roots were recorded. Also, the total alkaloids concentration (based on dry weight) was determined in the different parts of the plant according to the method described by Mahmoud (1983) and Masoud *et al.* (1968).

The total alkaloid yield (mg/plant part) was calculated (dry weight bases) as lycorine (the main component of Pancratium alkaloids).

The experimental design used was randomized blocks in four replicates and the data were statistically analysed according to Snedecor (1967).

RESULTS AND DISCUSSION

(1) Effect of sowing dates on the growth of *Pancratium maritimum* l.:

a) Fresh weight (in grams):

Tables 1 & 2 indicated that, the growth of Pancratium plant was affected by the sowing dates as the fresh weights of the whole bulbs and the different parts of the plants (leaves, bulbs and roots) were increased significantly when the early date of sowing was used, the highest fresh weights of the whole bulb and the different

parts were found in the early plantation of September 4th and 19th in 1988 and 1989 in all sampling dates.

It could be also observed from Table 2 that, the yield of the leaves decrease as the plants advanced in age. In other words, leaves of Pancratium plant attained their maximum growth in May and June while in August the leaves tended to wilt and then die off.

On the contrary, bulbs and roots growth generally increased as Pancratium plants advanced in age. The maximum growth was registered in August in most cases.

b) Dry weight (in grams):

Data tabulated in Table 3 clearly emphasized that, sowing date is very important factor in the production of the dry drug of Pancratium. It was observed that, sowing the plant early in September 19th in the first season and 4th in the second one resulted in the best results significantly with regard to the dry weights of the different parts of the plant.

The lowest values were obtained from the latest sowing date of November 19th in the two seasons.

The data pointed out that, August was found to be the best time for harvesting the drug as the dry weights of its different parts reached its highest values in August in most cases especially in the second season.

It could be concluded that, Pancratium growth in terms of fresh and dry weights of either the whole plant or its different organs were significantly influenced by the different sowing dates. The highest values were registered mostly with the earliest planting dates. These findings were in accordance with those of Hornok (1974) on dill plants, Mani and Sampath (1982) on *Digitalis Lanata* plants, Singh *et al.* (1987) on *Mentha arvensis* and El Gamal *et al.* (1990) on harmal plant. They found that, the time of planting is one of the important factors affecting the foliage yield and the suitable planting dates gave the best results in this respect.

Table 1. Fresh weight (g / bulb) of the whole bulb of *Pancratium maritimum* l. as influenced by sowing date.

Sowing dates	1987 / 88 Season			1988 / 89 Season		
	May	June	August	May	June	August
Sept. 4th				197.0	236.3	220.8
Sept. 19 th	180.1	220.3	223.0	115.0	156.6	135.0
Oct. 19 th	100.9	117.2	100.5	101.0	160.5	158.6
Nov. 19 th	30.8	43.5	35.7	48.0	96.1	95.6
L.S.D. (0.05)	72.20	131.6	33.39	45.2	74.64	41.17

Table 2. Fresh weights (g / plant part) of different parts of *Pancratium maritimum* l. as influenced by sowing date.

Sowing dates	Samples date								
	May			June			August		
	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots
	1987 / 88 Season								
Sept. 4th	--	--	--	--	--	--	--	--	--
Sept. 19 th	47.8	97.5	34.8	50.5	103.9	65.8	16.6	121.4	85.4
Oct. 19 th	27.8	49.8	23.2	33.8	65.0	41.7	--	59.9	40.5
Nov. 19 th	4.6	15.2	11.0	5.1	19.9	18.5	--	20.7	15.7
L.S.D. (0.05)	17.3	43.6	15.6	9.4	62.4	12.8		14.8	21.3
	1988 / 89 Season								
Sept. 4th	50.1	86.8	75.0	49.6	100.7	56.1	36.0	112.2	76.6
Sept. 19 th	33.5	57.6	39.9	28.9	75.7	46.8	19.1	64.3	52.0
Oct. 19 th	26.4	58.0	39.7	26.2	73.3	44.9	23.2	73.8	61.5
Nov. 19 th	17.3	32.2	30.3	8.8	35.6	28.2	9.0	43.0	43.7
L.S.D. (0.05)	10.5	19.9	19.9	24.3	9.52	20.25	17.9	2.9	13.8

Table 3. Dry weights (g / plant part) of different parts of *Pancratium maritimum* l. as influenced by sowing date.

Sowing dates	Samples date								
	May			June			August		
	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots
	1987 / 88 Season								
Sept. 4th	--	--	--	--	--	--	--	--	35.7
Sept. 19 th	6.18	20.84	4.36	6.2	33.3	9.5	--	27.5	8.2
Oct. 19 th	2.87	12.68	3.00	4.3	16.0	5.4	--	13.1	4.2
Nov. 19 th	0.47	3.49	1.01	0.7	5.3	2.0	--	4.6	1.6
L.S.D. (0.05)	0.78	9.28	0.59	1.0	2.47	1.19	--	3.65	3.36
	1988 / 89 Season								
Sept. 4th	7.21	23.85	6.99	5.94	22.81	8.08	4.65	28.0	7.1
Sept. 19 th	4.74	15.73	4.16	3.37	16.99	5.27	2.52	15.5	5.6
Oct. 19 th	3.51	15.64	3.59	2.95	16.53	5.46	2.98	17.7	6.9
Nov. 19 th	2.35	8.46	2.38	1.02	8.08	3.84	1.10	10.1	3.8
L.S.D. (0.05)	1.54	5.50	1.69	2.79	N.S.	N.S.	2.30	6.9	1.87

(2) The effect of sowing dates on the alkaloids production of *Pancratium maritimum* l.:

Data listed in Table 4 pointed out that, total alkaloid concentration did not respond to sowing date, in other words the sowing date did not affect the alkaloid percentage in the different plant parts, so no trend was found in this respect.

The data clearly indicated that, the alkaloid percentages in the different parts of the drug were found to increase consistently during the growing season and reached its maximum values in the last period of growth in August.

As for total alkaloid yield in the different parts of the plant, (Table 5), it could be noticed that, the bulb was the main storage part of the plant in which the alkaloid was found in the highest yield in comparison with the yield of other plant organ in all samples.

The results also indicated that, the alkaloid production was significantly affected by sowing date. The highest alkaloid yield in all plant parts was mostly conjugated with the early sowing date and vise versa. Accordingly, sowing Pancratium plants early in September 19th and 4th gave the best results in 1988 and 1989 respectively, while sowing the plant lately in November resulted in the lowest alkaloid yield in all plant parts.

It was also noticed, that, the alkaloid yield in all parts was increased as the plants advanced in age. The highest values of alkaloid yield (mg/plant) was detected in August in all sowing dates and in all plant parts. However, the majority of the alkaloid yield was found in the bulb.

It was important to indicate that, in August the highest alkaloid yield was found to be in harmony with both of the highest alkaloid percentages and the highest yield of the dry matter. This phenomenon could be explained by the accumulation of the photosynthates and the secondary metabolites in the bulbs during the growing season until the leaves of the plant begin to die off in August. This means that Pancratium plants reached the maturity stage in August and this period was found to be the best date for harvesting Pancratium plants.

These results were in agreement with those of Hornok (1974) on dill. The author found that, the highest yield of essential oil was produced when the plant was sown early in March. Mani and Sampath (1982) concluded that sowing date is one of the important factors affecting the glycoside content of *Digitalis lanata* plants. On

Table 4. Percentages of the total alkaloids in different Parts of *Pancartium maritimum* l. calculated as lycorin (based on dry weight).

Sowing dates	Samples date								
	May			June			August		
	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots
	1987 / 88 Season								
Sept. 4th	--	--	--	--	--	--	--	--	--
Sept. 19 th	0.1492	0.2425	0.2052	0.3357	0.2238	0.2238	0.6715	0.6342	0.4104
Oct. 19 th	0.1678	0.4477	0.2238	0.1492	0.2611	0.1492	--	0.4104	0.4477
Nov. 19 th	0.2987	0.2984	0.2984	0.2984	0.2611	0.4477	--	0.6715	0.3731
	1988 / 89 Season								
Sept. 4th	0.2798	0.3357	0.1492	0.2611	0.3357	0.3171	0.3731	0.5596	0.2984
Sept. 19 th	0.2425	0.4104	0.1865	0.2238	0.2611	0.2611	0.5223	0.5969	0.3171
Oct. 19 th	0.1865	0.4290	0.2425	0.2611	0.4477	0.2798	0.5223	0.3357	0.2611
Nov. 19 th	0.2238	0.3171	0.3731	0.2984	0.3731	0.2984	0.4477	0.4477	0.2984

Table 5. total alkaloid yield in different parts of *Pancratium maritimum* l. as influenced by sowing data (m / plant part) calculated as lycorin.

Sowing dates	Samples date								
	May			June			August		
	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots	Leaves	Bulbs	Roots
	1987 / 88 Season								
Sept. 4th	--	--	--	--	--	--	--	--	--
Sept. 19 th	9.22	58.77	10.37	25.94	89.99	15.97	--	177.36	37.52
Oct. 19 th	4.80	58.85	6.96	7.52	47.17	9.14	--	61.59	20.63
Nov. 19 th	1.40	1.63	3.37	2.62	14.51	9.30	--	33.05	6.45
L.S.D. (0.05)	3.28	11.34	2.47	9.15	27.38	3.57	--	28.56	3.41
	1988 / 89 Season								
Sept. 4th	20.17	80.06	10.22	15.52	85.76	25.63	17.34	156.81	21.18
Sept. 19 th	11.49	70.32	8.80	9.09	48.93	13.75	16.95	92.81	17.91
Oct. 19 th	6.55	67.08	8.71	7.71	74.00	15.29	15.58	59.49	18.01
Nov. 19 th	5.26	26.83	8.87	3.04	30.16	11.46	4.92	45.32	11.48
L.S.D. (0.05)	2.76	8.83	2.95	3.35	11.21	2.11	1.10	5.34	1.23

Mentha arvensis l. Singh *et al.* (1987) found that the oil yield was affected positively or negatively by the sowing date. El Gamal *et al.* (1990) obtained the highest alkaloid yield of harmal plants when the plant was sown early in September.

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تأثير ميعاد الزراعة على النمو وانتاج القلويدات فى البنكريشيم

السيد عبد الحميد الجمل ، عبد الفتاح محمد الزهوى ، ابراهيم محمد هريدى

تم دراسة تأثير ميعاد الزراعة على نبات البنكريشيم من حيث النمو وانتاج القلويدات وذلك فى مزرعة قسم بحوث النباتات الطبية والعطرية بالقناطر الخيرية وذلك فى موسمين متتالين ١٩٨٨ – ١٩٨٩ حيث درس ثلاث مواعيد زراعة فى العام الاول هى ١٩ سبتمبر ، ١٩ اكتوبر ، ١٩ نوفمبر أما في العام الثانى فقد درست الثلاث مواعيد السابقة بالاضافة الى ميعاد آخر هو ٤ ستبمبر.

وقد أظهرت النتائج أن الزراعة المبكرة للبنكريشيم فى ٤ سبتمبر تعطى أعلى محصول طازج وجاف للابصال الكاملة وكذلك الاجزاء المختلفة (الاوراق – الابصال – الجذور) وايضا أعلى محصول قلويدات بالمقارنة بالزراعات المتأخرة فى اكتوبر ونوفمبر وقد اتضح ايضا ان شهر اغسطس هو أنسب ميعاد لحصاد الابصال حيث تكون محصول القلويدات أعلى مايمكن بالمقارنة بشهري مايو ويونيو.