EFFECT OF POTASSEIN SPRAY ON GROWTH, AND CHEMICAL COMPOSITION OF *FURCREA FOETIDA CV.* "MEDIOPICTA" L. PLANTS

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Abstract

Cacetus and succulents plants are one of the most important sources of many medical compounds, pigments and coir so they have wide range of uses in landscape of gardens. The experimental trials presented in this paper was conducted throughout two successive seasons (2008 and 2009) at the nursery of Orman Botanical garden, Giza, aiming to find out the response of two types of potassein N (K-N) and potassein P (K-P) for producing plants of high quality. Potassein treatments, were applied on 1st March as a foliar spray for three times at monthly intervals at three levels (0.00, 3.00, 6.00 ml/L) and combination of both. Results indicated that plant height, stem diameter ,number of leaves/plant, leaf area, fresh and dry weights of leaves, root length, fresh and dry weights of roots as well as chlorophyll a and b, carotenoids contents and N, P and K percentages were significantly increased in response to the various treatments used in the current study comparing with that gained from untreated plants (control).

From ,the results it could be recommended that spraying the foliage of Furcrea foetida with (6 ml/L, K-N plus 6 ml/L K-P), three once every month during the growing season was the best treatments in producing highest quality of growth.

Keywords: Furcrea foetida , potassein N (K-N), potassein P (K-P), chemical composition.

INTRODUCTION

Furcrea foetida (*Agave foetida* Linn). Family Amaryllidaceae (Agavaceae) is Mauritius green Aloe, nearly trunk less lvs. to 8 ft.long, 8 in wide, with few ,distant curved in prickles 1/8 in long or more, cultivated widely in the Tropics and commercially in Mauritius and St. Helena for its fiber cv . Mediopicta . It is used as a pot plant for exhibition ,terrace garden ,as well as display of verandah and sunny building faces,(Bailey,1976) .Propagation of furcrea usually needs three years to get flowering plants from bulbles (seeds is usually rare).So in order to keep the quality and colour of the plant, it is preferable to use bulbles in propagation . As a rule ,furcreas bear fruit not more than once, and then die without producing suckers. However, they produce while in flower an immense number of bulbles, which may be used for propagation. It is impossible to say at what size or age the plants will bloom. On the other hand, plants from bulbles have been known to flower at three years. So

increasing the bulbles production on the mother plant is considered the main target from the commercial point of view .Foliar fertilization with macro and micronutrients leads usually to considerable growth and development responses. This is manly due to the face that foliar nutrients application easily overcomes limiting soil physiochemical conditions for root nutrient uptake and because nutrients are directly applied to foliage at times when demand is particularly high and rapid responses may be desired (Alexander, 1987). Potassium is very effectuation macro element on growth, development, flowering and yield of different plants, it is a well known factor affecting many function of plants as stomatal movement, flowering and yield of different plants. Potassein N and potassein P had a great effect for regulating photosynthesis, respiratory rates and activating many enzymes involved in plant growth, it also enhances translocation of sugars and carbohydrates through plant organs, increases proteins synthesis and different metabolic processes as well as reducing respiration hence energy losses (Csizinskey, 1999).

Potassium is a foliar fertilizer is available in two forms:- one fortified with nitrogen (Potassein-N) and the other with phosphorus (Potassein-P).Many investigators as Ismail *et al*., (2002) showed a significant stimulation on growth, root sugars and yield of sugar bear plants fertilized with either two forms of Potassein. Likewise, Mohamed and Naguib (2002) on fenugreek indicated the same observations,(fresh and dry weights of herb, chlorophyll pigment,carbohydrates and minerals content in the leaves were significantly improved as a result of spraying plants with K-P or K-N potessein at the rates of 3 or 6 L/fed. Shahin *et al*., (2007) noticed that fertilizer *Hibiscus rosa-sinensis* L. with potassein P (K-P, K-N), significantly increased chlorophyll a , b, cartenoids, N, P and K., Ibrahim (2009) *on Euphorbia splendes* found that potassein (K-P, K-N) as a foliar spray significantly increased growth and flowering of plant , chlorophyll a , b, cartenoids , N, P and K .

The objective of the study was to investigate the effect of potassein(K-P, K-N) spray on vegetative growth and chemical composition of *Furcrea foetida cv*. "Mediopicta" L plants.

MATERIALS AND METHODS

The experimental trial was consummated throughout two successive seasons (2008and 2009) at the nursery of Orman Botanical Garden , Giza. It was intended to find out the individual and combined effect of two types of potassein as a foliar spray on growth and chemical composition of *Furcrea foetida cv*. "Mediopicta" L .

Plant materials

Seedlings of *Furcrea foetida* transplants with initial height of 18-20 cm and carries 3-4 leaves were planted on 1st March in both seasons ,individually in plastic pots of 20 cm diameter filled with about 2.0Kg of a mixture of sand, loam and peatmoss (2:1:1,v:v:v).Therefore, the experimental trial was intended to produce vigorus, growth of *Furcrea foetida* plant by using either potassein (K-N and K-P) treatments which in turn increase bulbles yield and quality .

The seedlings were kept to grow under the condition of sunny area at the nursery. After one month from planting the plants were sprayed three times at one month interval till run off the solution with either potassein "K-N" (contains 30% K_2O and 8%N) or potassein "K-P" (contains 30% K_2O and 10% P_2O_5) at three levels of (3.00 or 6.00 ml/L), besides combinations of both (K-N and K-P) at also three different levels(3.00 or 6.00 ml/L for either K-N or K-P).

Physical properties of the used soil were analyzed according to A.O.A.C. (1985). Meanwhile, chemical properties of the used soil were analyzed according to Jackson (1985) shown in Table (a) .

Table a. Physical and chemical properties of the used mixture in the two seasons.

Season	Particles size distribution (%)						E.C. (dS/m)	pH	Cations (meq/L)			
	Coarse sand	Fine sand	Silt	Clay	Organic matter	CaCO3			Ca++	Mg++	Na+	K+
2008	15.2	25.5	18.4	36.4	1.70	2.80	2.99	7.58	7.55	2.34	10.90	0.75
2009	15.3	24.7	17.8	38.0	1.50	2.70	2.78	7.50	10.33	1.56	8.67	0.75

	Anions (meq/L)			Macro-and micro-elements (ppm)						
	HCO_3^-	Cl^-	SO_4^{--}	N	P	K	Fe	Zn	Mn	Cu
2008	3.94	8.64	8.96	164.20	17.01	370.50	12.00	3.70	7.62	8.76
2009	4.08	7.96	9.27	173.16	15.78	361.76	15.80	4.36	8.03	8.80

Besides a combination treatment between 3 ml/L. potassein N(K-N) and 3 ml/L potassein P (K-P) was applied to lump the benefits of both N and P.

Control plants were sprayed in the same times with a tap water, however all plants under various treatments were irrigated once every 5 days with 200 ml of water/pot(20 cm diameter) plant.

The following nine treatments were carried out as a foliar spray

- Control.(untreated plants)
- Potassein N 3 ml/L (K-N).
- Potassein N 6 ml/L (K-N).
- Potassein P 3 ml/L (K-P).
- Potassein P 6 ml/L (K-P).
- K-N 3ml/L + K-P 3ml/L.
- K-N 3ml/L + K-P 6ml/L.
- K-N 6ml/L + K-P 3ml/L.
- K-N 6ml/L + K-P 6ml/L.

At the end of every season(1st of October), the following data were recorded: plant height (cm), stem diameter (mm), above 5 cm. from the ground surface, number of leaves/plant, leaf area (cm^2) (the fifth leaves) by CL-203 AREA METER, CID, I were recorded for three randomly selected plants in each treatment .,root length (cm) and fresh and dry weights of leaves, and roots (g).

The chemical analysis of fresh leaves was conducted to determine their contents of chlorophyll (a , b) and total carotenoides mg/gm F.W., using the method described by Moran (1982), then total chlorophylls content was calculated. The total carbohydrates content in dry leaves was also determined using method recommended by Moran (1982), intended by Herbert *et al.,* (1971) while the phosphorus colorimetrically by Cottenie *et al.*, (1982) and potassium using flame photometer (Jackson, 1973) all of them as mg/g D.W. were measured, the content of nitrogen using micro-kjeldale method described by Jackson (1973).

The layout of the experiment in the two seasons was a complete randomized design (Das and Giri,1986) with 3 replicates as each replicates contained 5 plants. At the end of each seasons 1st of October data were then tabulated and subjected to analysis of variance according to MSTAT-C (1990) Computer statistical analysis program, while Duncan's Multiple Range Test (1955) was used to explore the significance between the means of various treatments.

RESULTS AND DISCUSSION

- Effect of potassein (K-N or K-P) on vegetative growth and roots parameter of *Furcrea foetida* , L.

Data of growth parameters presented in Table (1) indicate that the plant height and stem diameter were significantly increased by using potassein (N or P) at the rate of 3 or 6 ml/L or the combination of both at (K-N6 +K-P6) compared to control and other treatments.

Table 1. Effect of Potassein(N or P) as a foliar spray on plant height and stem diameter of *Furcrea foetida* in the two seasons (2008and 2009).

Treatments	Plant height (cm)		Stem diameter (mm.)	
	First season	Second season	First season	Second season
Control	26.1D	31.56D	1.36D	1.60C
K-P 3ml/L	34.74B	37.56B	1.8CD	2.81AB
K-P 6ml/L	32.64C	36.56B	2.16C	2.86AB
K-N 3ml/L	32.76C	37.4B	2.30BC	2.76B
K-N 6ml/L	31C	34.66C	2.10C	2.53B
K-P3ml/L+K-N 3ml/L	37.64A	39.46A	2.23BC	3.0A
K-P3ml/L+ K-P 6ml/L	38.4A	39.50A	2.7AB	3.0A
K-P6ml/L+K-N 3ml/L	37.64A	39.93A	2.96A	3.1A
K-P6ml/L+ K-P 6ml/L	39.44A	41.06A	3.06A	3.03A

Means within column having the same letters are not significantly different according to Duncan's multiple range test (DMRT)

Meanwhile, data recorded in Tables (2 &3) show that spraying potassein N or P or N+P at doses3&6 ml/L significantly increased number of leaves/plant and leaf area. Whereas, praying potassein at the doses of K-N6+K-P3 or K-N6+K-P6 significantly increased fresh and dry weights of leaves/plant compared with control means or either treatments used of the two seasons.

Table 2. Effect of Potassein(N or P) as a foliar spray on number of leaves / plant and leaf area of Furcrea foetida in the two seasons(2008and 2009).

Treatments	Number of leaves / plant		Leaf area (cm^2)	
	First season	Second season	First season	Second season
Control	5.33E	7.00E	50.74F	73.69G
K-P 3ml/L	7.66D	10.66BC	88.19DE	108.98CD
K-P 6ml/L	8.33CD	10.0CD	97.50DE	108.47CD
K-N 3ml/L	7.66D	9.00D	84.11E	102..21EF
K-N 6ml/L	8.33CD	9.66CD	79.72E	98.06F
K-P3ml/L+K-N 3ml/L	9.00C	11.66 AB	104.02BC	117.12BC
K-P3ml/L+ K-P 6ml/L	9.33BC	12.33A	97.50CD	115.89BC
K-P6ml/L+K-N 3ml/L	10.33A	12.00AB	111.91AB	124.82B
K-P6ml/L+ K-P 6ml/L	10.66A	12.00AB	118.31A	134.65A

Means within column having the same letters are not significantly different according to Duncan's multiple range test (DMRT)

Table 3. Effect of Potassein(N or P) as a foliar spray on fresh and dry weights of leaves / plant of Furcrea foetida in the two seasons(2008and 2009).

Treatments	Number of leaves / plant		Leaf area (cm^2)	
	First season	Second season	First season	Second season
Control	24.22F	28.51G	5.01D	8.21C
K-P 3ml/L	32.22E	41.92DEF	6.62C	10.27B
K-P 6ml/L	37.79D	46.47BC	7.18BC	12.69A
K-N 3ml/L	31.97E	36.72F	6.55C	9.74B
K-N 6ml/L	34.51E	39.54EF	6.61C	9.61BC
K-P3ml/L+K-N 3ml/L	38.65CD	49.92BCD	7.79B	13.33A
K-P3ml/L+ K-P 6ml/L	41.64A	53.74AB	9.15A	13.66A
K-P6ml/L+K-N 3ml/L	41.19AB	57.67AB	8.92A	13.37A
K-P6ml/L+ K-P 6ml/L	46.14A	58.94A	9.51A	14.19A

Means within column having the same letters are not significantly different according to Duncan's multiple range test (DMRT)

Data scored in Table (4) show clearly that root parameters of *Furcrea foetida cv*. mediopicta L was influenced by using potassein treatment in fertilization . In this connection, applying potassein at different levels (K-N6 +K-P3 or K-N6 + K-P6) revealed highly significant increment on root length and its fresh and dry weights in both seasons.

Table 4. Effect of Potassein(N or P) as a foliar spray on root length and fresh and dry weights of roots of Furcrea foetida in the two seasons(2008and 2009).

Treatments	Root Length (cm)		Fresh weight of Root /plant (gm.)		Dry weight of Root/ plant (gm.)	
	First season	Second season	First season	Second season	First season	Second season
Control	9.90G	11.46E	3.22F	3.11C	1.88F	1.82D
K-P 3ml/L	14.54CD	16.10BC	3.62EF	4.22B	2.18DE	2.18BCD
K-P 6ml/L	15.54BC	16.83B	4.22BCD	4.38B	2.20DE	2.14CD
K-N 3ml/L	12.34F	13.73D	3.81DEF	4.09B	2.19DE	2.09CD
K-N 6ml/L	13.60EF	15.23C	3.92EF	4.09B	2.41CD	2.08CD
K-P3ml/L+K-N 3ml/L	14.56CD	17.16B	4.43BC	5.55AB	2.97AB	2.47BC
K-P3ml/L+K-P 6ml/L	15.70BC	18.36A	4.85AB	5.08B	2.78BC	2.53B
K-P6ml/L+K-N 3ml/L	16.80AB	19.26A	4.99AB	5.53AB	3.03AB	2.55B
K-P6ml/L+K-P 6ml/L	18.03A	19.43A	5.41A	5.86A	3.27A	2.94A

Means within column having the same letters are not significantly different according to Duncan's multiple range test (DMRT)

The increment on vegetative and root growth of Euphorbia due to potasseins application might be attributed to function of potassium on cell division and elongation, carbohydrates and protein synthesis, activating translocation of sugars and starch in plant organs, as well as its role as a Co-factor for about 60 enzymes involved in plant. Ismial *et al.,* (2002) scored a significant stimulation on growth, root sugars and yield of sugar-beet plants fertilized with either forms of potassein. Likewise, Mohamed and Naguib (2002) on Fenugreek indicated that plant height, number of branches/plant, fresh and dry weights of herb, chlorophylls pigments, carbohydrates and minerals content in the leaves were significantly improved as a result of spraying with K-P or K-N potassein at the rates of 3 or 6 L/fed .

The effect of nutrition was mainly studied by application N, P and K as main nutrients in several forms. However, the current work is an attempt to study the response of *Furcrea foetida cv*. "Mediopicta" L., plant to foliar spray with two forms of potassein-N (K-N), potassein- P (K-P) and the combined treatment of both on growth develop, and chemical composition. Csizinskey (1999) which were reflected in taller plants bearing more leaves and branches containing more metabolites and food reserves and consequently heavier plant weight. Such improvement of potassein forms on plant growth traits was also observed by Ahmed, (2002) on *Horworthia forciata.* In addition to the great contribution of N plant materials as it is a main constituent of all proteins and nucleic acid as well as of both structural and non-structural components of plant cells, besides involving P in energy transfer process and is building of phospholipids and nucleic acid.

Effect of potassein (K-N or K-P) on chemical composition of *Furcrea foetida*

From data averaged in Table (5), it is clear that the contents of chlorophyll a, b and carotenoids (mg/g F.W.), total carbohydrates (mg/g D.W.) and the percentages of N, P and K were markedly increased in the leaves of fertilized plants due to the different treatments of fertilization, with the excellence of the high rate of potassein fertilizer (K-N6+K-P6ml/L) that gave the utmost high means in the two seasons with significant differences when compared to means of either control or other treatments.

These results come in response to the role played by N in chlorophylls and amino acids synthesis and P which contributes in regulating the opening and closing of stomata and possible membrance turgar that effect chlorophyll properties and phosphorus would activate various metabolic processes and it is involved in energy transfer process during building of phospholipids and nucleic acid Ahmed (2002).

Moreover, P provides plant metabolic process with phosphate bond which are necessary for building pigments and other constituents Ahmed, (2002). Several workers referred to the stimulatory effects of K, P and N fertilization on chlorophyll and other constituents formations as Shahin *et al.,* (2007)on *Hibiscus rosa-sinensis L.*

Finally ,from the previously stated results it could be recommended to spray the foliage of *Furcrea foetida cv*." Mediopicta" L. transplants grown is 20 cm diameter pots thrice with a combination of 6 ml/L potassein N at 6 ml/L potassein P at one month interval to get vigour growth .

Table 5. Effect of Potassein(N or P) as a foliar spray on chemical composition of *Furcrea foetida*.

Treatments	Chlorophyll A (mg/g F.W.)	Chlorophyll B (mg/g F.W.)	Carotenoids (mg/g F.W.)	Total carbohydrates (mg/g.D.W)	N %	P %	K %
Control	3.61F	.99H	1.57G	5.61H	0.57E	0.33DE	0.24G
K-P 3ml/L	4.21D	1.39E	1.73E	9.47G	0.68D	0.17E	2.41E
K-P 6ml/L	4.87C	1.47C	1.79D	12.09F	0.74C	0.37DE	1.88F
K-N 3ml/L	3.97E	1.19G	1.6F	15.32E	0.66D	0.37DE	1.93F
K-N 6ml/L	4.18DE	1.37F	1.8D	16.06D	0.68D	0.41CDE	2.33E
K-P3ml/L+K-N 3ml/L	4.87C	1.41D	1.86C	18.65C	0.76C	0.581BCD	2.93D
K-P3ml/L+K-P 6ml/L	5.13AB	1.45C	1.88BC	18.87C	0.83B	0.66AB	3.39C
K-P6ml/L+K-N 3ml/L	5.02BC	1.71B	1.89B	19.68B	0.95A	0.73AB	3.72B
K-P6ml/L+K-P 6ml/	5.28A	1.94A	1.93A	20.85A	0.96A	0.86A	3.93A

Means within column having the same letters are not significantly different according to Duncan's multiple range test (DMRT)

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تأثير الرش بالبوتاسين على النمو والتركيب الكيماوي لنبات الفوركاريا

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قسم بحوث نباتات الزينة وتنسيق الحدائق- معهد بحوث البساتين – مركز البحوث الزراعية - الجيزة – جمهورية مصر العربية

النباتات الشوكية والعصارية واحده من أهم المصادر للعديد من المركبات الطبية والصبغات والألياف . بالإضافة إلى أهميتها القصوى لاستخدامها في إغراض متباينة في طرز تنسيق الحدائق وتبعاً لذلك فقد تم تنفيذ التجربة الحالية خلال موسمين زراعيين متتاليين ٢٠٠٨ و ٢٠٠٩ بمشتل حديقة الآورمان النباتية بالجيزة بهدف التعرف على التأثيرات الهامة أو المفيدة لرش المجموع الخضري لشتلات نبات الفوركاريا بنوعين من المغذى الو رقى بوتاسين أحداهما يحتوى على النتروجين(K-N) والآخر على الفسفور (K-P) بهدف الحصول علي نباتات قوية جيدة الصفات وعلى هذا فقد استخدم كلا نوعى البوتاسين عن طريق رش الأوراق لثلاث مرات على فترات شهرية بدءاً من أول مارس بمعدلات صفر ، ٣ ، ٦ ميللتر وكذلك المعاملات المشتركة.

وقد أوضحت النتائج المتحصل عليها ما يلي:-

- حدوث زيادة معنوية في ارتفاع النبات وسمك الساق وعدد الأوراق والوزن الطازج والجاف للأوراق وطول الجذر والوزن الطازج والجاف للجذور لكل نبات وكذلك محتوى الأوراق من كلوروفيل ا، ب والكاروتينات و عناصر النتروجين والفسفور والبوتاسيوم ، والكربوهيدرات الكلية نتيجة لرش مختلف المعاملات التي طبقت في هذه الدراسة في كلا موسمي النمو مع المعاملات المشتركة والتي أعطت بصفة عامة أعلى المتوسطات في جميع القياسات المذكورة سابقا عند مقارنتها بالكنترول والمعاملات الأخرى.
- وعلى ذلك يفضل رش المجموع الو رقى (الخضري) لشتلات الفوركاريا المنزرعة في أصص بلاستيك قطرها ٢٠ سم بتوليفة من ٦ميللى/لتر بوتاسين (K-N) + ٦ميللى/ لتر(K-P) ثلاث مرات كل شهر للحصول على اعلي جودة للنمو.