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EFFECT OF POTASSIUM FERTILIZATION ON POTATO TUBERS NUTRIENTS CONTENT AND THEIR STORAGE ABILITY

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ABSTRACT

Field experiments were carried out in a farm neighboring the experimental farm of the Faculty of Agriculture, Kafr El-Sheikh during the two successive early summer seasons of 1998/99 and 1999/2000 to study the effect of K fertilization (as soil application at the levels of 50 and 100 kg. K_2O/fed) and foliar spraying with 1% K_2O solution (as K-sulphate) once (at 60, 75 or 90 days after planting, DAP), twice (60 and 75, 60 and 75 or 75 and 90 DAP) and thrice (at 60, 75 and 90 DAP) on mineral nutrient elements and their ratios and storage ability (sprouting and weight loss) of potato (*Solanum tuberosum* L.) tubers cv. Cara.

The results indicated that application of K at 50 kg K_2O/fed lead to significantly higher tuber N content and sprouting percentage than 100 kg K_2O/fed in both seasons. Otherwise, fertilization of K at 100 kg K_2O/fed had significantly higher tuber K content and K: P ratio than 50 kg K_2O/fed in both seasons. On the other hand, P, Na, N: P and K: N ratios and total weight loss percentage in tuber were not affected by K levels in both seasons.

Foliar sprays of K twice at 60 and 75 DAP significantly increased tuber N, P and K: N ratio and decreased N: P and K: N ratios, weight loss percentage and sprouting percentage compared with the other treatments in both seasons. Moreover, tuber K content was significantly increased when the plants were sprayed with K once at 75 DAP or twice at 60 and 75 DAP in the first season, or sprayed with K twice at 75 and 90 DAP or thrice at 60, 75 and 90 DAP in the second season. On the other hand, Na content of tuber was not significantly affected by number and times of foliar K application in both seasons.

The interaction between soil applied K levels and number and times of foliar K application had no significant effects on mineral nutrient elements (N, P and Na) and their ratios (N: P, K: N and K: P ratios) and sprouting percentage in both seasons. However, it had significant effects on total weight loss percentage of tubers in the first season and on tuber K content in both seasons.

INTRODUCTION

Potato is the fourth important crop in the world and one of the most important vegetable crops grown in Egypt. Potato tuber are bulky, heavy and perishable that make transportation and storage of tubers expensive (Sadik, 1983; Malagamba, 1988).

The effect of soil potassium levels on N, P and K contents in tubers was studied by many workers. Smirnova (1978) used 90 to 120 kg $_2O$/ha and showed that N content in tubers was not affected by K levels. However, Holm and Nylund (1978) reported that increasing K level up to 280 kg K_2O/ha decreased N content in tuber.

On the contrary, other workers reported that N content in tubers increased by increasing soil K levels Moursi and Makram, 1966; El-Hamdi and Dawa, 1990).

The effect of K levels on phosphorus content in tubers was studied by many investigators (Holm and Nylund, 1978; Smirnova, 1978; El-Hamdi and Dawa, 1990). They reported that increasing K levels (from 0 up to 280 kg K_2O/ha did not affect the P content in tubers. However, Moursi and Makram (1966) reported that increasing K rates tended to increase P content in tubers.

With respect to the effect of K rates on K content in potato tuber, there are some reports, increasing K rates increased K content of tubers (Moursi and Makram, 1966; Sharma *et al.,* 1978; Smirnova, 1978; Maity and Arora, 1980; El-Hamdi and Dawa, 1990).

Foliar fertilization with K is one mean that might have an important effect in improving quality of potato tubers (Abdel-Ati, 1998; El-Sawy *et al.,* 2000) and increasing N, P and K contents in tubers (Taha and El-Sayed, 1991; Abdel-Ati, 1998).

Beukema and Van der Zaag (1990) noted that there are tuber losses during storage, i.e., water loss by evaporation (main weight loss), respiration, sprouting, infection by fungi and bacteria (soft rots, dry rots .. etc).

Effect of N, P and K on storage losses and sprouting has been studied by many workers. Isaeva and Kostyuk (1975) found that application of farmyard manure (F.Y.M.) plus NPK or PK increased the keeping quality of resulting tubers during storage and increased their resistance to stem nematode (*Ditylenchus dipsaci*), dry rot (*Fusarium solani*) and wet rot (*Pseudomonas xanthochlora, Erwinia carotovora* and *E. aroideae*). However, application of N, NK and NPK without F.Y.M. decreased the keeping quality of tubers. Moreover, Basu (1986) found that the percentage of rotted tubers during storage increased with increasing N, NP and NPK rates, but it decreased with the lower P and PK rates. Oberg (1975) found that application of height rates of P and K decreased the intensity of biological processes in tuber during storage, decreased utilization of starch, DM, respiration intensity and storage losses, but high rates of applied N increased them. Furthermore, El-Gamal (1988) reported that high levels of N resulted in great losses in tuber weight and earlier sprouting under nawwala storage conditions, while K reduced tuber weight loss and retarded tuber sprouting. However, P effect on stored tubers was lower than the effect of the other two elements. Effect of K on stored tubers has been studied by many workers. El-Gamal *et al*. (1993) reported that K levels (as K-sulphate) tended to extend the dormancy period and reduced weight loss after three months of the nawwala stored seed tubers. Moreover, Singh *et al*. (1996) reported that the lowest storage losses and sprouting percentage in tubers stored for 14 weeks were obtained when the potato plants were fertilized with 180 kg K_2O/ha. Also, Dubey *et al*. (1997), noted that storage behaviour improved with up to 100 kg K_2O/ha.

Hence, the main objective of this work was to study the effect of soil and foliar application of K on potato tuber mineral nutrient elements and their

ratios in relation to tuber storage ability (as determinated by weight loss and sprouting).

MATERIALS AND METHODS

Two field experiments were conducted in a farm neighboring the Experimental Farm of the Faculty of Agriculture at Kafr El-Sheikh, Tanta University during the early summer seasons of 1998/99 and 1999/2000 to evaluate the effects of soil potassium fertilization and foliar application of potassium at different times on mineral nutrient elements and their ratios and storage ability of potato tubers. Certified potato tuber seeds of cv. Cara was used.

The soil of the Experimental Farm had a clay texture. Soil analyses done according to Jackson (1967) are presented in Table (1).

Table (1): Soil analyses at the experimental sites.

Season	pH	Organic matter %	EC (mmhos/cm)	Soluble cations (meq/100 g soil)			
				N	P	K	Na
1998/1999	8.05	0.98	4.00	4.7	1.5	1.9	7.8
1999/2000	8.20	1.25	4.15	6.5	2.7	2.3	7.9

The experiment included 14 treatments, which were the combination of two potassium levels, i.e., 50 and 100 kg/fed (as soil application) with seven potassium foliar treatments of 1% K_2O solution (as potassium sulphate 48% K_2O).

Foliar potassium application was done as follows:

1. Once at 60 DAP (days after planting).
2. Once at 75 DAP.
3. Once at 90 DAP.
4. Twice at 60 and 75 DAP.
5. Twice at 60 and 90 DAP.
6. Twice at 75 and 90 DAP.
7. Thrice at 60, 75 and 90 DAP.

The treatments were arranged in a split-plot design with four replications. The two soil potassium levels were arranged in the main plots and the seven treatments of foliar K application were assigned at random to the sub-plots. Each experimental unit (16.8 m^2) consisted of four ridges, each ridge was six m long and 70 cm wide. Potato seed pieces were planted on December 3rd and harvested on April 4th in both seasons.

Nitrogen was added as ammonium sulphate at the level of 90 kg N/fed, and this quantity was divided into two equal parts and applied as side dressing at 45 and 60 DAP. Phosphorus was broadcasted during soil preparation at the rate of 75 kg P_2O_5/fed in the form of super phosphate. The quantity of K fertilizer (as potassium sulphate 48% K_2O) was added at 60 DAP. Other cultural practices were done as locally recommended for potato production.

Data recorded:

1.Chemical analysis of tubers:

Total nitrogen, phosphorus, potassium and sodium contents of dried tuber were determinated using the Micro-kjeldahl method for N determination (Pregl, 1945), Spectrophotometer for P determination (Piper, 1947; King 1951) and using flame photometer for K and Na estimation (Jackson, 1967). Thereafter, N: P ratio, K: N ratio and K: P ratio were calculated.

2.Storage ability:

Five kg of tubers from each experimental plot were packed after harvest in net plastic bags and stored for three months at normal room temperature (25-35^{o}C and 65-75% RH). Determination of weight loss percentage and sprouting percentage in stored tubers were estimated after two months from harvesting date.

Data were tested by analysis of variance using Duncan's multiple range test (Duncan, 1955) for the comparison among treatment means.

RESULTS AND DISCUSSION

1.Effect of potassium levels:

A.Mineral nutrient elements in tubers:

Data in Table (2) show that N content in tubers was significantly decreased with increasing K levels from 50 up to 100 kg K_2O/fed, i.e., the potato plants fertilized with 50 kg K_2O had higher N content in tubers than those in the plants fertilized with 100 kg K_2O/fed in both seasons. In this concern, Smirnova (1978) reported that N content in tubers was not affected by using K levels from 90 to 120 kg K_2O/ha. However, Holm and Nylund (1978) reported that further increase in K level up to 280 kg K_2O/ha decreased tubers N content.

Table (2): Effect of soil applied potassium levels on mineral nutrient elements (in dry matter) and their ratios and storage ability of potato tubers (1998/99 and 1999/2000 seasons).

Soil K levels (kg/fed)	N (%)	P (%)	K (%)	Na (%)	N: P ratio	K: N ratio	K: P ratio	Total weight loss % (at 60 days)	Sprouting % (at 60 days)
1998/99 season									
50	1.914 a	0.370	1.896 b	0.20	5.173	0.991	5.124 b	8.44	76.43 a
100	1.838 b	0.338	1.906 a	0.20	5.438	1.037	5.639 a	10.07	66.43 b
F test	*	N.S	*	N.S	N.S	N.S	*	N.S	**
1999/2000 season									
50	1.879 a	0.598	2.441 b	0.34	3.142	1.299	4.082 b	7.13	72.14 a
100	1.721 b	0.579	2.548 a	0.34	2.972	1.481	4.401 a	7.14	60.71 b
F. test	*	N.S	*	N.S	N.S	N.S	*	N.S	**

****, * and N.S. indicate significant difference at P < 0.01, P < 0.05 and not significant respectively, according to F. test.**

Duncan's test was used (at 5% level) for comparison between treatment means.

Regarding the P content in tubers, data in Table (2) show that the supply of K had no significant effect. However, increasing the K rate from 50 to up 100 kg K_2O/fed tended to decrease P content in tubers. In the same line, many workers reported that increasing K levels did not affect the P content in tubers (Holm and Nylund, 1978; Smirnova, 1978; El-Hamdi and Dawa, 1990). However, Moursi and Makram(1966) reported that increasing K levels tended to increase P content of tubers.

Respecting the K content in tuber (Table 2) , it was significantly increased with increasing K rates from 50 up to 100 kg. K_2O/fed in both seasons. Similar results were reported by many investigators (Moursi and Makram 1966; Sharma *et al.,* 1978; Smirnova, 1978; Maity and Arora, 1980; El-Hamdi and Dawa, 1990; Taha and El-Sayed, 1991, Abdel Ati, 1998). With respect to the sodium content in tuber, it was not affected by K levels in both seasons (Table 2).

B.Mineral nutrient elements ratios (N: P, K: N and K: P ratios) in tubers:

Data in Table (2) indicate that plants fertilized with 100 kg K_2O/fed produced tubers having higher N: P, K: N and K: P ratios than those of plants which were fertilized with 50 kg K_2O/fed in both seasons.

C.Storage ability:

I.Percentage of total weight loss of potato tubers:

Data in Table (2) indicate that the total losses in tuber weight were not affected by K levels in both seasons.

2.Sprouting percentage:

Data in Table (2) demonstrate that increasing K levels from 50 to 100 kg K_2O/fed significantly decreased the percentage of tubers sprouting. In this connection, El-Gamal 1988 showed that K retarded tubers sprouting. Also, El-Gamal *et al*. (1993) reported that K levels tended to extend the dormancy period. Moreover, Singh *et al*. (1996) found that the lowest sprouting percentage in tubers stored for 14 weeks was observed when potato plants were fertilized with 180 kg K_2O/ha.

The reduction of tuber sprouting by K fertilization at the level of 100 kg K_2O/fed may be due to decreased N content and increased K content and K: N and K: P ratios in potato tubers (Table 2).

II.Effect of number and times of foliar K application:

A.Mineral nutrient elements in tubers:

Data in Table (3) show that number and times of foliar K application had a significant effect on N content in tubers in the first season only. Such effect was insignificant in the second season. Foliar fertilization with K once at 75 DAP and twice at 60 and 75 DAP resulted in the highest N content in tubers in the first season.

Regarding the P content of tubers, it was significantly increased by foliar application of K two times at 60 and 75 DAP in both seasons.

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Concerning the K content in tubers, it was significantly influenced by number and times of foliar K application in both seasons, but no constant trend was followed in both seasons. The highest K content in tubers was obtained from the plants sprayed with K two times at 60 and 75 DAP in the first season, and from the plants sprayed two times (at 75 and 90 DAP) and three times (at 60, 75 and 90 DAP) in the second season. In this concern, Abdel-Ati (1998) reported that K content in tubers dry matter increased with increasing number of foliar applications. As regards the Na content in tubers, it was not significantly affected by number and times of foliar K application in both seasons.

B.Mineral nutrient elements ratios (N: P, K: N and K: P ratios) in tubers:

Data in Table (3) indicate that foliar K application twice at 60 and 75 DAP caused a significant reduction in N: P and K: P ratios and increase in K: N ratio in tubers in both seasons. On the other hand, foliar K application thrice at 60, 75 and 90 DAP significantly increased N: P and K: P ratios in tuber in both seasons.

C.Storage ability:

1.Percentage of total weight loss of potato tubers:

Data in Table (3) reveal that number and times of foliar K application had a significant effect on percentage of total tuber weight loss in the first season. The lowest total loss in weight of tubers was found when the plants were sprayed with K twice at 60 and 75 DAP and thrice at 60, 75 and 90 DAP in both seasons. The beneficial effect of K fertilization for reducing weight loss of tubers during storage was detailed by many workers (Oberg, 1975; El-Gamal, 1988; El-Gamal *et al.,* 1993; Singh *et al.,* 1996; Dubey *et al.,* 1997; Bansal and Umar, 1998).

2.Sprouting percentage:

Data presented in Table (3) illustrate that foliar K application twice at 60 and 75 DAP significantly decreased sprouting percentage of tubers compared with the other treatments in both seasons. The reduction of sprouting percentage in tubers induced by this treatment may be due to increased tuber P content and reduced N: P, K: N and K: P ratios of tuber (Table 3). In this concern, Kireeva and Kiryukhin (1974) reported that total P content of the tuber was higher in the varieties with a short dormancy.

III.Effect of the interaction between soil applied K levels and number and times of foliar K application:

Data in Tables (4 & 5) show that mineral constituents (N, P and Na contents), mineral ratios (N: P, K: N and K: P ratios) and total weight loss of tubers were not significantly affected by the interaction between soil applied K levels and times of foliar K sprays in both seasons. However, K content in tubers was significantly affected by the interaction, but there was no constant trend in either seasons.

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With respect to the sprouting percentage in stored tubers, the interaction had a significant effect on this character in the first season. The highest total weight loss percentage was obtained when potato plants were fertilized with
100 kg K_2O/fed and sprayed with K_2O (1%) twice at 60 and 90 DAP or one at 90 DAP, while the lowest total weight loss was found when the plants were fertilized with 100 kg K_2O/fed and sprayed with K_2O three times at 60, 75 and 90 DAP. The beneficial effect of K fertilization on reducing weight loss in tubers during storage were noted by many investigators (Oberg, 1975; El-Gamal, 1988; El-Gamal *et al.,* 1993; Singh *et al.,* 1996; Dubey *et al.,* 1997; Bansal and Umar, 1998).

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تأثير التسميد البوتاسى على محتوى العناصر الغذائية بدرنات البطاطس وقدرتها التخزينية

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أجريت تجربتان حقليتان فى حقل مجاور للحقل التجريبى بكلية الزراعة بكفرالشيخ ـ جامعة طنطا ، فى الموسم الصيفى المبكر لعامى 1999/1998 ، 2000/1999 وذلك لدراسة تأثير التسميد البوتاسيومى بطريقة الإضافة الأرضية عند المستويين 50 ، و100كجم بو2أ/فدان ، وبطريقة الرش الورقى بمحلول من سماد سلفات البوتاسيوم عند تركيز 2% (1% بو2أ) ، وذلك برش النباتات ، أما مرة واحدة (60 يوما أو 75 يوما أو 90 يوما بعد الزراعة) ، أو مرتان (60 ، و75 يوما أو 60 ، و90 يوما أو 75 ، و 90 يوما بعد الزراعة) ، أو ثلاث مرات (60 ، و75 ، و90 يوما من الزراعة) ، على محتوى العناصر الغذائية ونسبها والقدرة التخزينية لدرنات البطاطس صنف كارا.

ولقد أوضحت النتائج أن التسميد بالبوتاسيوم عند المستوى 50كجم بو2أ/فدان أعطى أعلى محتوى من النتروجين ، وأعلى نسبة تزريع للدرنات عن المستوى 100كجم بو2أ/فدان ، وكانت الفروق جوهرية فى كلا الموسمين ، وعلى العكس تسبب التسميد بالمستوى 100 كجم بو2أ/فدان فى زيادة جوهرية لكل من محتوى البوتاسيوم ، ونسبة البوتاسيوم إلى الفوسفور بالدرنات أكثر من المستوى المنخفض (50كجم بو2أ/فدان) فى كلا الموسمين. ومن ناحية أخرى لم يتأثر كل من محتوى الفوسفور ، والصوديوم ، ونسبة النتروجين إلى الفوسفور ، ونسبة البوتاسيوم إلى النتروجين للدرنات ، ونسبة الفقد الكلى فى الوزن للدرنات بمستويات التسميد فى كلا الموسمين ، ولقد تسبب التسميد الورقى بمحلول البوتاسيوم (1% بو2أ) مرتين (عند 60 ، و75 يوما بعد الزراعة) فى زيادة معنوية لكل من محتوى النتروجين ، والفوسفور ، ونسبة البوتاسيوم إلى النتروجين بالدرنات ، وعلى العكس تسببت تلك المعاملة فى نقص معنوى لكل من النسبة بين النتروجين والفوسفور ، والنسبة بين البوتاسيوم والنتروجين ، ونسبة الفقد الكلى فى الوزن ، والتزريع للدرنات وذلك بالمقارنة بالمعاملات الأخرى فى كلا الموسمين. بالإضافة إلى ذلك ازداد محتوى الدرنات من البوتاسيوم معنويا وذلك عندما رشت النباتات بمحلول البوتاسيوم مرة واحدة (عند 75 يوما بعد الزراعة) ، أو مرتين (عند 60 ، و75 يوما بعد الزراعة) وذلك فى الموسم الأول ، أو عندما رشت النباتات بالبوتاسيوم مرتين (عند 75 ، و90 يوما بعد الزراعة) أو ثلاث مرات (عند 60 ، و75 ، و90 يوما بعد الزراعة) فى الموسم الثانى ومن ناحية أخرى ، لم يتأثر محتوى الدرنات من الصوديوم بعدد مرات وميعاد الرش الورقى بالبوتاسيوم فى كلا الموسمين.

لم يؤثر التفاعل بين معدل التسميد البوتاسى الأرضى وبين عدد مرات وميعاد التسميد الورقى على كل من محتوى الدرنات من العناصر الغذائية (نتروجين ، فوسفور ، صوديوم) والنسب بين تلك العناصر (نتروجين الى فوسفور ، بوتاسيوم الى نتروجين ، بوتاسيوم الى فوسفور) ، ونسبة التزريع بالدرنات فى كلا الموسمين ـ ولكن كان هناك تأثير للتفاعل على كل من الفقد الكلى فى وزن الدرنات فى الموسم الأول ، ومحتوى الدرنات من البوتاسيوم فى كلا الموسمين.

Table (3): Effect of number and times of foliar K application on mineral nutrient elements (dry weight basis) and their ratios and storage ability of potato tubers (1998/99 and 1999/2000 seasons).

Number and times of foliar K application (days after planting)		N (%)	P (%)	K (%)`	Na (%)	N: P ratio	K: N Ratio	K: P ratio	Total weight loss % (at 60 days)	Sprouting % (at 60 days)
1998/99 season										
Once	(60)	1.800 ab	0.404 a	1.748 b	0.22	4.455 cd	0.971	4.327 b	8.36 cd	75 b
	(75)	2.084 a	0.350 ab	2.000 a	0.19	5.954 abc	0.959	5.714 ab	9.63 c	85 b
	(90)	1.600 b	0.350 ab	1.942 ab	0.22	4.571 cd	1.214	5.549 ab	10.88 b	62.5 c
Twice	(60 and 75)	2.017 a	0.473 a	1.990 a	0.21	4.264 d	0.987	4.207 b	7.15 d	20 d
	(60 and 90)	1.933 ab	0.350 ab	1.957 ab	0.20	5.523 bcd	1.012	5.591 ab	12.13 a	60 c
	(75 and 90)	1.800 ab	0.284 b	1.930 ab	0.20	6.338 ab	1.072	6.796 a	9.25 c	100 a
Thrice	(60, 75 and 90)	1.900 ab	0.267 b	1.742 b	0.21	7.116 a	0.917	6.524 a	7.39 d	100 a
F test		**	**	**	N.S	**	N.S	**	*	**
1999/2000 season										
Once	(60)	1.675	0.525 ab	2.347 b	0.33	3.190 b	1.401 ab	4.471 bc	7.22	67.5 b
	(75)	1.775	0.638 ab	2.277 b	0.34	2.782 cd	1.283 b	3.569 bc	6.90	62.5 b
	(90)	1.725	0.550 b	2.380 b	0.33	3.136 cd	1.379 ab	4.327 c	6.94	62.5 b
Twice	(60 and 75)	1.750	0.755 a	2.640 ab	0.34	2.318 d	1.509 a	3.497 c	6.74	20 c
	(60 and 90)	1.800	0.613 ab	2.300 b	0.37	2.936 cd	1.278 b	3.752 c	7.63	60 b
	(75 and 90)	1.975	0.650 ab	2.824 a	0.36	3.039 cd	1.429 ab	4.345 c	7.64	100 a
Thrice	(60, 75 and 90)	1.900	0.388c	2.844 a	0.34	4.897 a	1.497 ab	7.330 a	6.82	92.5 a
F. test		N.S	**	**	N.S	*	*	**	N.S	**

****, * and N.S. indicate significant difference at P < 0.01, P < 0.05 and not significant respectively, according to F. test.**
Duncan's test was used (at 5% level) for comparison between treatment means.

Table (4): Effect of the interaction between soil applied K level and number and times of foliar K application on some mineral nutrient elements (dry weight basis) in potato tuber (1998/99 and 1999/2000 seasons).

	N %		P %		K %		Na %	
K level (kg/fed)	50	100	50	100	50	100	50	100
No. and times and foliar K application (DAP)								
1998/99 season								
Once (60)	1.800	1.800	0.4000	0.4100	1.683 abc	1.813 a-c	0.23	0.20
(75)	2.067	2.100	0.4333	0.2667	1.953 a-c	2.047 ab	0.19	0.19
(90)	1.533	1.667	0.3667	0.3333	1.953a-c	1.930 a-c	0.19	0.24
Twice (60 and 75)	2.067	1.967	0.4900	0.4567	1.980 ab	1.999 ab	0.19	0.22
(60 and 90)	1.733	2.133	0.3667	0.3333	2.100 a	1.813 a-c	0.20	0.19
(75 and 90)	1.933	1.667	0.3000	0.2667	1.930 a-c	1.930 a-c	0.20	0.19
Thrice (60, 75 and 90)	2.267	1.533	0.2333	0.3000	1.670 c	1.813 a-c	0.23	0.18
F-test	N.S		N.S		*			
1999/2000 season								
Once (60)	1.65	1.70	0.500	0.550	2.297 bc	2.397 bc	0.33	0.33
(75)	1.90	1.65	0.550	0.725	2.297 bc	2.257 c	0.33	0.35
(90)	1.90	1.55	0.575	0.525	2.597 a-c	2.163 c	0.33	0.32
Twice (60 and 75)	1.95	1.55	0.760	0.750	2.803 a-c	2.477 bc	0.35	0.33
(60 and 90)	1.80	1.80	0.675	0.550	2.190 c	2.410 bc	0.37	0.36
(75 and 90)	1.90	2.05	0.650	0.650	2.667 a-c	2.980 ab	0.37	0.34
Thrice (60, 75 and 90)	2.05	1.75	0.475	0.300	2.537 a-c	3.150 a	0.32	0.36
F-test	N.S		N.S		*			

*** and N.S. indicate significant difference at P < 0.05 and not significant respectively, according to F. test.**

Values having the same alphabetical letters within each two columns are not significantly different at the 5% levels, according to Duncan's test.

Table (5): Effect of the interaction between soil applied K level and number and times of foliar K application on mineral nutrient elements ratios (dry weight basis) and storage ability of potato tubers (1998/99 and 1999/2000 seasons).

	N: P ratio		K: N ratio		K: P ratio		Weight loss % (at 60 days)		Sprouting (at 60 days)	
K level (kg/fed)	50	100	50	100	50	100	50	100	50	100
No. and times of foliar K application (DAP)										
1998/99 season										
Once (60)	4.500	4.390	0.935	1.007	4.208	4.422	6.85 fg	9.86 c-e	50	100
(75)	4.770	7.874	0.945	0.975	4.507	7.675	6.76 fg	12.50 ab	70	100
(90)	4.181	5.002	1.274	1.158	5.326	5.791	9.86 c-e	11.90 a-c	100	25
Twice (60 and 75)	4.218	4.307	0.958	1.016	4.041	4.377	6.80 fg	7.50 e-g	15	20
(60 and 90)	4.726	6.399	1.212	0.850	5.727	5.439	10.96 b-d	13.29 a	100	25
(75 and 90)	6.443	6.251	0.998	1.158	6.433	7.237	8.11 d-g	10.39 b-d	100	100
Thrice (60, 75 and 90)	9.717	5.110	0.737	1.183	7.158	6.043	9.72 c-e	5.06 g	100	100
F-test	N.S		N.S		N.S		*		N.S	
1999/2000 season										
Once (60)	3.300	3.091	1.392	1.410	4.594	4.358	7.89	6.55	60	75
(75)	3.455	2.276	1.209	1.368	4.176	3.113	6.07	7.73	50	75
(90)	3.304	2.952	1.367	1.396	4.517	4.120	7.10	6.78	100	25
Twice (60 and 75)	2.566	2.067	1.437	1.598	3.688	3.303	7.18	6.39	15	25
(60 and 90)	2.667	3.273	1.217	1.339	3.244	4.382	7.17	8.08	90	30
(75 and 90)	2.923	3.154	1.404	1.454	4.103	4.585	7.59	7.69	100	100
Thrice (60, 75 and 90)	4.316	5.833	1.238	1.800	5.341	10.500	6.90	6.74	90	95
F-test	N.S		N.S		N.S		N.S		N.S.	

*** and N.S. indicate significant difference at P < 0.05 and not significant respectively, according to F. test.**
Values having the same alphabetical letters within each two columns are not significantly different at the 5% levels, according to Duncan's test.