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RESPONSE OF POTATO TO SOME GROWTH SUBSTANCES UNDER ORGANIC AND INORGANIC FERTILIZATION

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ABSTRACT

Response of tuber yield and chemical composition of potato cv. Nicola to some growth substances GA_3 (200 ppm), methionine (100 ppm) and Pix (300 ppm) under complementary fertilizer between farmyard manure (FYM) and inorganic was studied during the two growing seasons 2001 and 2002 in El-Salhia, Sharkia Governorate . The results indicated that spraying of Pix increased whereas GA_3 decreased tuber yield / plant and feddan. The highest values of specific gravity and dry matter (%) resulted from GA_3 and Pix respectively . Spraying GA_3 gave the highest N, P and K contents in the tuber . Application of the three growth substances increased Fe content especially Pix treatment .

Potato plants fertilized with 50% FYM + 50% NPK produced the highest number of tubers / plant , tuber yield / plant, tuber yield / fed and tuber diameter as well as starch % while, the heaviest tuber weight resulted from 100% NPK. The highest value of N% resulted from application of 25% FYM + 75% NPK . P and Fe contents were increased by increasing FYM level . Opposite trend was observed with K content .

Concerning the interaction between growth substances and fertilizer, the results indicated that farmyard manure treatments were more effective on tuber yield / fed than the growth substances. The interaction between 50% FYM + 50% NPK and Pix increased significantly tuber yield / plant, tuber yield / fed and tuber diameter as well as Fe content compared to control (100% NPK with spraying water) . The highest values of tuber weight and dry matter % were obtained with control. GA_3 combined with 50% FYM + 50% NPK gave the highest specific gravity but , it gave the lowest dry matter % and TSS% . The combination of the growth substances with 50% FYM + 50% NPK increased starch % as compared with 100% NPK. 25% FYM + 75% NPK with spraying water recorded the highest free amino acids and proteins contents . GA_3 combined with fertilizer treatments had an effect on increasing N and P % .

Keywords : Potato, GA3, methionine , Pix , farmyard manure (FYM)

INTRODUCTION

Potato (*Solanum tuberosum* L.) is considered as one of the most important vegetable crops allover the world. The formation of vegetative storage organs in plants, viz, tubers and bulbs, is often influenced by environmental conditions , the most prominent factors being fertilizer and hormones.

Growth substances are used to regulate growth and improve productivity and quality of various plant species (Leopoled and Kriedman, 1975). The role of gibberellic acid (GA_3), methionine and Pix on growth, yield and chemical compositions of many plants was studied by many investigators . Vreugdenhil and Sergeeva (1999) mentioned that gibberellins are major regulators of potato tuber formation. Gibberellins inhibit tuberization, cause stolons to elongate rather than to swell, inhibit starch accumulation and the synthesis of tuber – specific proteins. The endogenous levels of gibberellins and especially of GA_1 are low under conditions favouring tuberization , and high under non – inductive conditions.

Ethylene is formed from methionine via – S – adenosyl – L – methionine and the cyclic, nonprotein amino acid 1 – aminocyclopropane –1-carboxylic acid (Kende, 1993). It is unclear whether ethylene plays a role in the process of tuberization; both stimulating and inhibitory effects have been reported. Catchpole and Hillman (1969) reported that ethylene induced tuber formation in young light – grown potato sprouts . Garcia – Torres and Gomez – Campo (1973) found that ethylene enhanced tuberization in etiolated sprouts cultured *in vitro* . Opposite effects of ethylene on tuberization *in vitro* were reported by Mingo – Castel *et al.,* (1976).

Rademacher (2000) showed that plant growth retardants are applied in agronomic and horticultural crops to reduce unwanted longitudinal shoot growth without lowering plant productivity . Most growth retardants act by inhibiting gibberellin (GA) biosynthesis . Mepiquat chloride , well known as Pix is a potential systemic plant growth regulator (Ramachandra *et al.,* 1996). The positive effect of Pix application on tuber yield was reported by Sakr *et al.,* 1989; Eyob and Krishnappa, 1999a and Tavares and Lucchesi, 1999.

Dudhat *et al.,* (1997) mentioned that addition of organic manures has shown considerable increase in crop yield and exert significant influence on physical, chemical and biological properties of soil . But, its use alone is not sufficient to meet the requirement of nutrients . Therefore, use of both organic manures and chemical fertilizers in appropriate proportion assumes special significance as complementary and supplementary to each other in crop production.

Farmyard manure (FYM) has a considerable effect on increasing tuber yield (Saghin, 1989; Sood *et al.,* 1994; Recke *et al.,* 1997; Arisha and Bardisi, 1999). The combination between NPK and FYM was found to be more effective in increasing potato yields (Efremov and Samoilov, 1985; Hussein and Radwan, 2002 b).

A great attention to the use of bioagriculture in potato production , using organic fertilizers, in order to reduce plant and soil contamination with different elements and also to reduce the used mineral fertilizers, is considered recently . So, this study was designed to evaluate the effects of some growth substances (GA_3 , methionine and Pix) and the complementary fertilizer between NPK and farmyard manure on yield and chemical composition of potato in sandy soil .

MATERIAL AND METHODS

A field experiment was conducted in El – Salhia, Sharkia Governorate during the two growing seasons of 2001 and 2002 , to study the effects of some growth substances and the complementary effect of farmyard manure (FYM) with chemical fertilization on yield and chemical constituents of potato (*Solanum tuberosum* L. cv. Nicola) under sandy soil . The analyses of experimental soil and farmyard manure are presented in Table (1) .

The expriment included 12 treatments which were the combination of three fertilizer treatments and four growth substances treatments as follows:

i) Fertilization treatments :
   1- 100% NPK (200 Kg N+ 46.5 Kg P_2O_5 + 96 Kg K_2O_2/fed)
   2- 25% FYM + 75% NPK
   3- 50% FYM + 50% NPK

ii) Growth substances treatments :
   1- Control (water)
   2- Gibberellic acid (GA_3) at the rate of 200 ppm
   3- Methionine at the rate of 100 ppm
   4- Pix (mepiquat chloride) at the rate of 300 ppm

Ammonium sulphate (20.6%N) and potassium sulphate (48% K_2O) were applied in two equal doses at 30 and 60 days after planting . While, calcium superphosphate (15.5% P_2O_5) was applied during soil preparation.

Table (1): Some physical and chemical properties of soil and farmyard menure (FYM).

Soil properties		FYM properties	
Sand %	84.6	PH	7.6
Silt %	12.6	Organic matter %	21.7
Clay %	2.8	Total N %	0.45
Texture	Sandy	Total P%	0.39
pH	7.9	Total K %	1.18
O.C.%	1.17		
Total N%	0.035		
Total P%	0.014		
Total K %	0.019		

Farmyard manure was applied during soil preparation in mid – row according to analysis done the same source at rate 60 m^3 / fed that was expected to supply the same amount of nitrogen to potato plants in plots that received chemical fertilizer .

The treatments were arranged in split plot design with three replicates . The fertilizer treatments were distributed randomly in main plots and the growth substances were arranged randomly in sub-plots. Plot area was 10.5 m^2, which included 4 rows of 3.5m long and 75 cm wide each.

Potato seed tubers cv. Nicola were planted at 25cm apart during the 1st week of February in both seasons .

The plants were sprayed twice with growth substances (GA_3, methionine and Pix), the first one after 45 days from planting . One month later the second spray was performed in the two seasons. The normal agricultural practices of growing potato were followed according to the Ministry of Agriculture recommendations .

After 110 days from planting, the plants were harvested and sample of five plants was taken at random from each plot, where the following data were recorded : number of tubers per plant, tubers weight per plant (g) tuber weight (g) , tuber diameter (cm) , specific gravity and total soluble solids percentage (TSS % using hand Refractometer) as well as dry matter content. Tuber yield (ton / fed) was determined from the harvest of each plot. Samples from tubers of each treatment were subjected to the following chemical analyses : total nitrogen (%) by modified micro kjeldahl (Chapman and Pratt, 1978), phosphorus % (Troug and Mayer, 1939), potassium % (Brown and Lilleland, 1946), soluble sugars (Dubois *et al.*, 1956), starch and

proteins (A.O.A.C., 1970). Iron content was determined by atomic absorption spectrophotometer (Zeiss PMG-3) apparatus.

The obtained data were subjected to the analysis of variance according to Steel and Torrie (1980). LSD at 5% level of significance was used to compare between means . The combined data of the two seasons were recorded after testing the homogenity of the variance .

RESULTS AND DISCUSSION

1.Tuber yield and its components :

1.1 Effect of growth substances :

As sown in Fig. (1) spraying all applied growth substances decreased number of tubers / plant and GA3 treatment gave the lowest value. These results could be supported by the findings of Vreugdenhil and Sergeeva (1999) who mentioned that application of gibberellins to the shoots of potato had an inhibitory effect on tuberization, causing stolons to elongate rather than to swell . Vreugdenhil and Dijk (1989) found a dual role of ethylene in the induction of tuber formation in potatoes, it had positive effect by blocking the elongation of stolons and suppressing tuber intiation. Also, Sakr *et al.*, (1989) found that ethrel and Pix decreased number of tubers / plant .

Using the three growth substances increased tuber weight and the increase amount was significant with methionine and Pix compared to control . Also , Eyob and Krishnappa (1999a) found that the heaviest tuber weight resulted from CCC and paclobutrazol treatments .

Application of Pix increased significantly both tuber yield / plant and/ feddan compared to control. Similar results were obtained by Eyob and Krishnappa (1999a) . In this connection, Sakr *et al.*, (1989) mentioned that the increase in tuber yield may be due to the effects of ethrel and Pix application on increasing cytokinin levels within the plant tissues and photosynthetic pigments, as well as dry matter. On the other hand , spraying GA_3 decreased tuber yield / plant and / feddan. Similar finding was obtained by Caldiz *et al.*, (1998) on potato.

The results show that spraying of methionine or Pix – resultedin plants were actually larger in tuber diameter while, GA_3 treatment decreased significantly it compared with control (Fig.1). These results were in agreement with Sakr *et al.*, (1989) who found that ethrel and Pix increased tuber size . Escalante and Langille (1998) reported that GA_3 reduced tuber diameter.

The highest values of specific gravity and dry matter (%) resulted from spraying the plants with GA_3 and Pix, respectively . While, using Pix gave the lowest specific gravity . These results reflect that the application of Pix at 300 ppm had an effective role in increasing dry matter % of tuber, which could be attributed to the increment in tuber size and weight .

No significant variation in TSS % was obtained due to spraying the three growth substances . Also , El – Seifi and Moursy (1991) found that the percentage of TSS in fruit juice of strawberry was not significantly affected by CCC treatments.

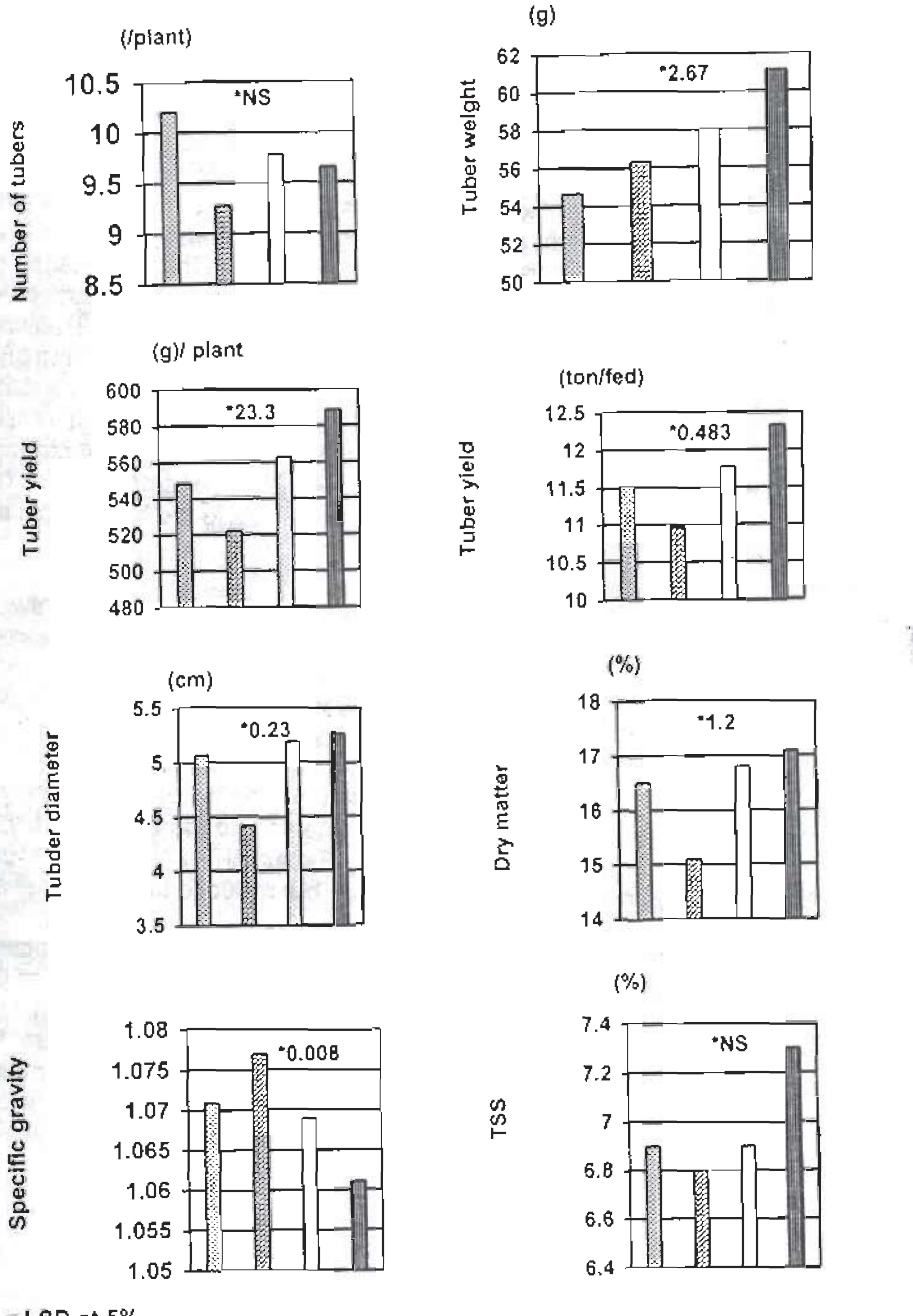


Fig.(1) : Effect of GA_3, methionine and Pix on yield attributes and quality of potato tuber.

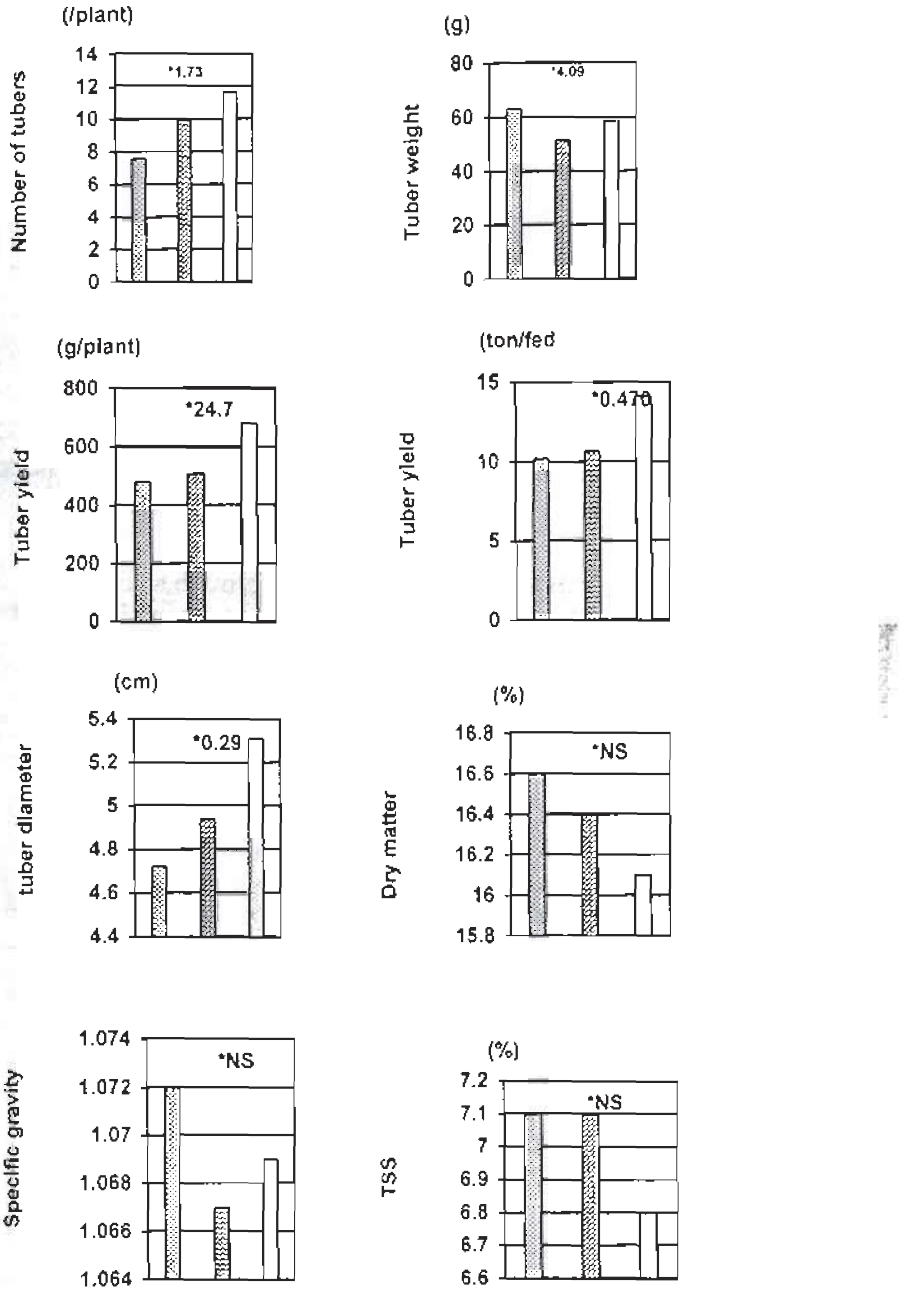
1.2 Effect of fertilizer :

Fig (2) illustrated that addition of nutrients demand to potato plants as 50% farmyard manure (FYM) + 50% NPK (chemical fertilizer) produced the highest number of tubers / plant, tuber yield / plant and / feddan as well as tuber diameter . In this regard, Kurmysheva and Efremov (1998) reported that the best indicators of yield and quality of potato were obtained with a level of organic nitrogen fertilizer up to 40% of the total rate of nitrogen applied . Also , fertilizing the potato plants with 25% FYM + 75% NPK increased tuber yield / plant and feddan . These increments were significant compared to the standard treatment (100% NPK). On the other hand , the heaviest tuber weight resulted from fertilizing the plants with 100% NPK . These results are coincided with those obtained by Hussein and Radwan (2002a) on potato. The superiority of farmyard manure in improving tuber diameter, number of tubers / plant and tuber yield / plant might be attributed to the favourable and beneficial effects of farmyard manure in increasing potato plant growth which, in turn, increased tuber yield / feddan . Insignificant differences in dry matter percentage, specific gravity and TSS were noticed for fertilizer treatments. Similar trend was found by Hussein and Radwan (2002a,b).

1.3 Effect of interaction :

The data in Tables (2 and 3) indicate that the combination between farmyard manure treatments with the three growth substances increased number of tubers / plant , tuber yield / plant and tuber yield / fed . From the foregoing results, it is clear that the interaction between 50% FYM + 50% NPK and Pix treatment led to a significant increase in tuber yield / plant and tuber yield / fed. compared to control (100% NPK + water) . While , the lowest number of tubers / plant and tuber yield / fed resulted from spraying GA_3 with 100% NPK. Farmyard manure treatments had more effect on tuber yield / fed than the growth substances . Escalante and Langille (1998) reported that GA_3 increased rhizome length, but reduced tuber number and fresh mass.

The highest values of tuber weight and dry matter % were obtained by using 100% NPK without growth substances . The combination of GA_3 with 100% NPK or 25% FYM + 75% NPK decreased significantly tuber diameter compared to control (100% NPK with water) . On the contrary, Pix-treated plants under fertilizing with 50% FYM + 50% NPK gave the highest tuber diameter. GA_3 combined with 50% FYM + 50% NPK gave the highest specific gravity but , it gave the lowest dry matter % and TSS%. The interaction treatments did not cause significant differences in TSS%.



* = LSD at 5%

100% NPK | 25% FYM + 75% NPK | 50% FYM + 50% NPK

Fig.(2) : Effect of farmyard manure (FYM) and chemical fertilization on yield attributes and quality of potato tuber

Table (2) :Effect of combination between some growth substances and fertilizer on yield attributs of potato (combined analysis of the two seasons)

Treatments	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK
	Number of tubers / plant			Tuber weight (g)		
Control	7.83	10.67	12.13	65.60	41.97	56.43
GA_3	7.17	9.67	11.00	57.00	55.44	56.54
Methionine	7.67	9.67	12.00	64.87	51.87	57.47
Pix	7.72	9.72	11.54	64.93	55.77	62.63
LSD at 5%	1.74			7.10		
	Tuber yield / plant (g)			Tuber yield (ton/fed)		
Control	513.6	447.8	684.5	10.896	9.439	14.259
GA_3	408.7	536.1	621.9	8.656	11.272	12.958
Methionine	497.6	501.6	689.6	10.567	10.548	14.212
Pix	501.3	542.1	722.8	10.665	11.381	14.955
LSD at 5%	88.3			1.688		

Table (3): Effect of combination between some growth substances on quality characters of potato (combined analysis of the two seasons)

Treatments	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK
	Tuber diameter (cm)			Dry matter (%)		
Control	4.84	4.83	5.52	16.7	16.7	16.0
GA_3	4.16	4.26	4.83	15.1	15.1	15.0
Methionine	4.96	5.07	5.56	17.1	17.1	16.2
Pix	4.92	5.58	5.31	17.6	16.8	17.0
LSD at 5%	0.46			NS		
	Specific gravity			TSS (%)		
Control	1.073	1.064	1.075	7.1	6.8	6.8
GA_3	1.075	1.073	1.083	6.9	7.1	6.5
Methionine	1.066	1.078	1.063	6.9	7.1	6.8
Pix	1.074	1.053	1.055	7.6	7.2	7.1
LSD at 5%	0.015			NS		

2.Biochemical constituents :

2.1 Effect of growth substances :

Fig (3) illustrated that GA_3 treatment gave a significant increase in soluble sugars as well as protein content compared with control and Pix or methionine treatments. In this connection, El-Keltawi *et al.*, (2000) found that GA_3 increased protein content in cumin fruits . Moreover, spraying both methionine and Pix resulted in a significant decrease in soluble sugars and

protein content compared to untreated plants. But, application of methionine and Pix gave a significant increase in starch percentage compared with control (Fig. 3). Also, Eyob and Krishnappa (1999 b) found that starch content of potato tuber was the highest after paclobutrazol treatments. GA_3 – treated plants produced less starch than control. Supporting this view, Sharm *et al.*, (1998) mentioned that CCC increased starch content of potato tuber by 11% compared with untreated controls, whereas GA_3 decreased starch content by about 13% . A very high reducing sugar content in the stem of GA_3-treated crops indicated active hydrolysis of sucrose coming from the leaves – leading to reduced supply to tubers because of further possible sucrose hydrolysis while, passing through the long stolons. However, in the CCC-treated crops, the higher chlorophyll content of the leaves with reduced stolon length promoted efficient sucrose supply to the tubers.

Free amino acids content was increased by using Pix, and GA_3 while, methionine decreased it significantly compared with control . In this respect, El-Mergawi *et al.*, (1999) found that spraying GA_3 increased soluble sugars and free amino acids contents of onion bulb compared with untreated plants .

2.2 Effect of fertilizer :

Data presented in Fig (4) indicated that there was no significant effect of fertilizer treatments on both soluble sugars and protein content. In this connection, Arisha and Bardisi (1999) mentioned that carbohydrate content in tuber was no affected by FYM. While, the highest values of soluble sugars and protein resulted from 25% FYM + 75% NPK treatment (Fig.4) . Also , Patel and Patel (1991) found that application of farmyard manure increased the grain – protein content of chickpea. Application of 50% FYM + 50% NPK increased significantly starch percentage compared with 100% NPK or 25% FYM + 75% NPK . Free amino acids content was decreased by using farmyard manure (25% or 50%) compared with 100% NPK.

2.3 Effect of Interaction :

From the foregoing results in Table (4) , it is clear that the interaction between GA3 and fertilizer treatments led to an increase in the soluble sugars content especially when GA3 combined with 25% FYM + 75% NPK (29.24 mg/g) . While, there was no effect of methionine or Pix under fertilizer treatments . Combination of the growth substances with 50% FYM + 50% NPK increased starch percentage as compared with 100% NPK . Opposite trend was observed with free amino acids content .

Fertilizing potato plants with 25% FYM + 75% NPK without spraying growth substances recorded the highest free amino acids and protein contents compared with the other combination treatments. But, it recorded the lowest starch percentage. Gradually increase in protein content was found with increasing farmyard manure combined with GA_3.

3- Minerals content :

3.1 Effect of growth substances :

Data in (Fig. 4) show that GA_3 gave the highest nitrogen , phosphorus and potassium contents which attained to the level of significant compared with control and other treatments except N% of untreated plants . In this respect, El- Keltawi *et al., (2000)* on cumin, El-Khateeb *et al.*, (1991)

on *Ruta graveolens* and El-Shamy (1988) on violet, found that nitrogen content was increased by GA_3 application . On the other hand, spraying methionine or Pix decreased significantly N, P and K contents as compared to control . Also , El – Khateeb *et al* ., (1991) revealed that appliction of CCC at 500 ppm gave the lowest K value while GA3 increased P content in leaves of *Ruta graveolens*. Application of the three growth substances increased Fe content especially Pix treatment compared to untreated plants .

3.2 Effect of fertilizer :

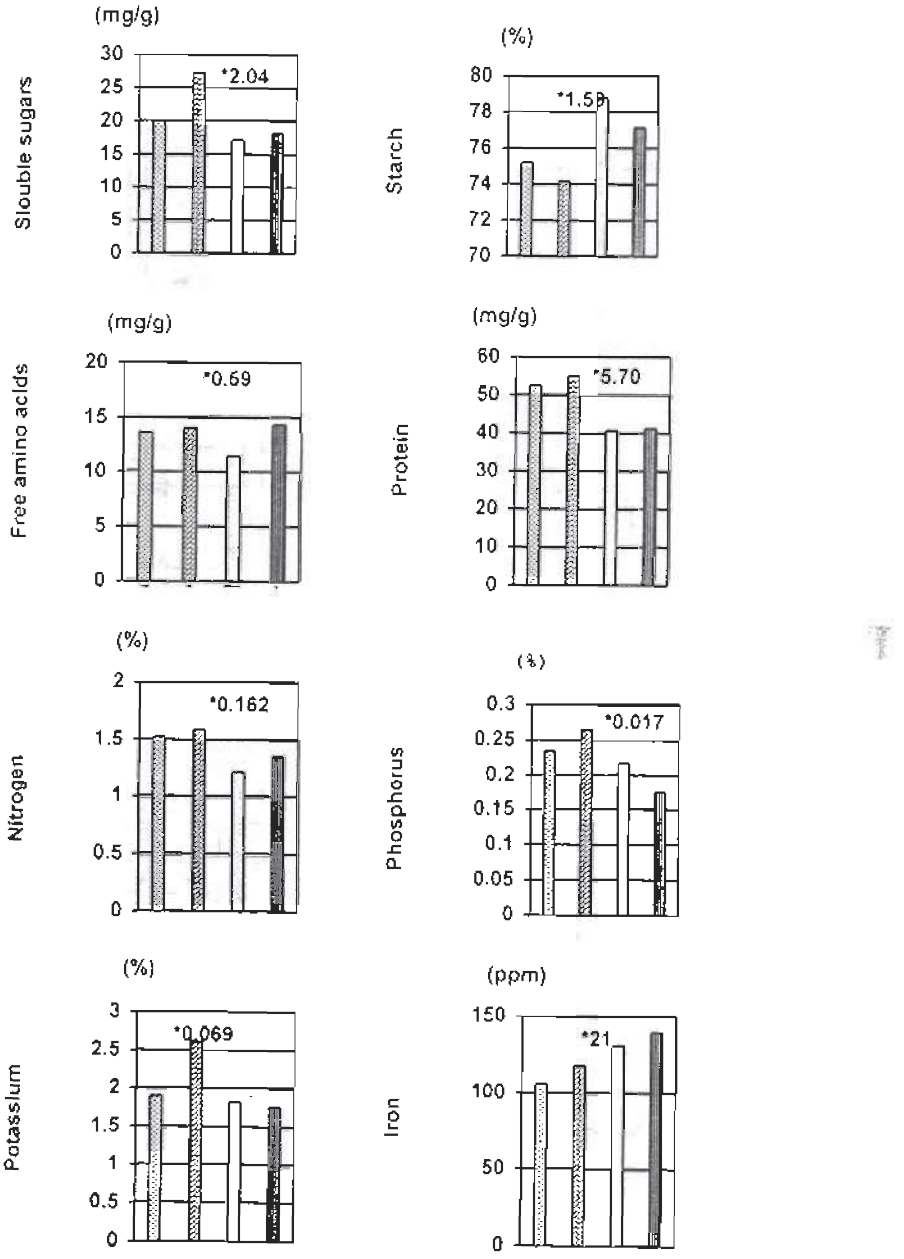
The highest value of nitrogen content (1.516%) resulted from application of 25% FYM + 75% NPK, but, there was a significant decrease at 50% FYM + 50% NPK compared with 100% NPK or 25% FYM + 75% NPK (Fig.4) .In accordance, Radwan and Farahat (2002) found that NPK fertilizer increased nitrogen conten of coriander fruits as compared with farmyard manure .

Phosphorus and iron contents were significantly increased with increasing farmyard manure level. So, the highest values of P and Fe contents resulted from 50% FYM + 50% NPK . On the other hand , increasing farmyard manure level decreased significantly potassium content compared with 100% NPK or 25% FYM + 75% NPK (Fig.4). In this regard, Hussein and Radwan (2002b) found that organic fertilizer increased phosphorus content but, it decreased nitrogen and potassium contents compared with NPK fertilizer. Kuszelewski *et al.*, (1996) reported that farmyard manure improved mineral uptake in barley and wheat plants.

3.3 Effect of interaction :

Results in Table (5) show that the interaction between GA_3 and fertilizer treatments had an effect on increasing nitrogen and phospharus contents compared with combination of the other treatments. Spraying GA_3, Pix or untreated plants under fertilizing with 25% FYM + 75% NPK increased potassium content compared with 100% NPK or 50% FYM + 50% NPK. Opposite trend was obtained with methionine under 25% FYM + 75% NPK which produced the lowest K content (1.653%). The combination between growth substances and fertilizer treatments resulted in a gradual increase in Fe content with increasing FYM level, and the highest concentration of Fe (196 ppm) resulted from Pix combined with 50% FYM + 50% NPK.

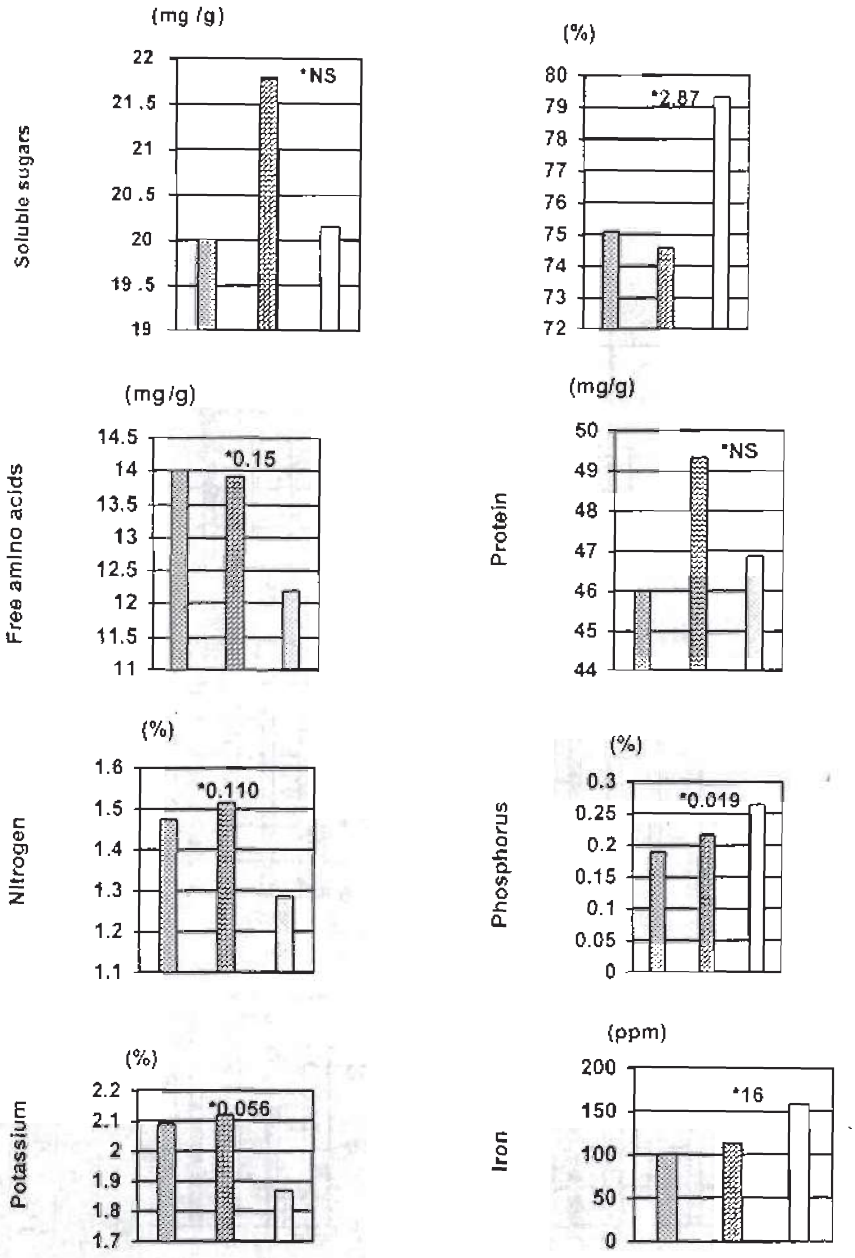
It could be concluded that the treatments 50% FYM + 50% NPK proved to be more effective in increasing tuber yield and its quality, thus it is recommended for improving potato productivity .



* = LSD at 5%

Control GA_3 Methionine Pix

Fig.(3) : Effect of GA_3, methionine and Pix on chemical compositions of potato tuber .



* = LSD at 5%

NPK 100% NPK 25% FYM + 75% NPK 50% FYM + 50%

Fig.(4) : Effect of farmyard manure (FYM) and chemical fertilization on chemical compositions of potato tuber .

Table (4) : Effect of combination between some growth substances and fertilizer on biochemical constituents of potato. (combined analysis of the two seasons)

Treatments	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK
	Soluble sugars (mg/g)			Starch (%)		
Control	18.88	24.33	16.90	78.12	66 80	80.69
GA_3	24.60	29.24	27.87	73.54	73.17	75.86
Methionine	18.65	15.25	17.54	76.01	80 40	80.05
Pix	17.95	18.30	18.30	72.77	78.00	80.69
LSD at 5%	7.61			6.37		
	Free amino acids (mg/g)			Protein (mg/g)		
Control	13.79	15.74	11.40	45.95	62.65	48.93
GA_3	13.90	14.79	13.41	49.15	55.78	60 25
Methionine	13.41	10.73	10.24	49.03	39.41	33.87
Pix	14.99	14.37	13.70	39.86	39.48	44.46
LSD at 5%	3.56			12.05		

Table (5) : Effect of combination between some growth substances and fertilizer on minerals content of potato tuber (combined analysis of the two seasons).

Treatments	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK	100% NPK	25% FYM + 75% NPK	50% FYM + 50% NPK
	Nitrogen (%)			Phosphorus (%)		
Control	1.563	1.788	1.225	0.223	0.233	0.249
GA_3	1.738	1.625	1.415	0.242	0.272	0.282
Methionine	1.325	1.125	1.213	0.152	0.210	0.291
Pix	1.275	1.525	1.290	0.141	0.153	0.233
LSD at 5%	0.274			0.064		
	Potassium (%)			Iron (ppm)		
Control	1.886	2.125	1.691	94	98	126
GA_3	2.811	2.850	2.185	98	112	144
Methionine	1.906	1.653	1.911	104	124	166
Pix	1.756	1.850	1.695	108	116	196
LSD at 5%	0.343			38		

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استجابة البطاطس لبعض مواد النمو تحت التسميد العضوى وغير العضوى

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دُرست استجابة محصول الدرنات والمحتوى الكيماوى لنبات البطاطس صنف نيقولا لبعض مواد النمو (الجبريللين والمثيونين والبكس بتركيزات ٢٠٠ ، ١٠٠ و ٣٠٠ جزء في المليون على الترتيب بالتداخل مع التسميد المتكامل (كيماوى وبلدى) وتم ذلك خلال موسمى ٢٠٠١ ، ٢٠٠٢ في منطقة الصالحية بمحافظة الشرقية – وأظهرت النتائج ما يلى :

اولاً : مواد النمو

- أوضحت النتائج زيادة محصول الدرنات للنبات والفدان عند رش البكس ولكن تسبب استخدام الجبريللين إلى حدوث نقص لمحصول الدرنات للنبات والفدان وأدى استخدام المثيونين أو البكس إلى حدوث زيادة في قطر الدرنة بينما رش الجبريللين أحدث نقص معنوى في قطر الدرنة مقارنة بالكنترول .
- اعطى رش الجبريللين أعلى قيم للكثافة النوعية ومحتوى الدرنات من النيتروجين والفوسفور والبوتاسيوم – ونتجت أعلى نسبة مئوية للمادة الجافة من استخدام البكس كما أدى استخدام مواد النمو الثلاثة إلى زيادة محتوى الدرنات من الحديد خصوصا مع معاملة البكس .

ثانيا – التسميد : –

- أوضحت النتائج أن التسميد المشترك (٥٠% بلدى و ٥٠% كيماوى) أنتجت أكبر عدد من الدرنات للنبات وأعلى محصول درنات للنبات والفدان وقطر الدرنة بالإضافة إلى النسبة المئوية للنشا . بينما نتج أقل وزن للدرنة من استخدام التسميد الكيماوى ١٠٠%.
- أدى التسميد المشترك بنسبة ٢٥% بلدى و ٧٥% كيماوى إلى الحصول على أعلى محتوى للنيتروجين – كما ادت زيادة نسبة السماد البلدى في السماد المشترك إلى زيادة محتوى الفوسفور والحديد ولكن حدث العكس مع البوتاسيوم .

ثالثا : التداخل بين مواد النمو والتسميد

- أوضحت النتائج ان المعاملات المحتوية على سماد بلدى كانت أكثر تأثيرا على محصول الدرنات للفدان من معاملات مواد النمو – لذلك اعطى السماد المشترك ٥٠% بلدى و ٥٠% كيماوى مع رش البكس زيادة معنوية في محصول الدرنات للنبات والفدان وقطر الدرنه بالإضافة الىمحتوى الدرنات من الحديد مقارنة بالكنترول (سماد كيماوى ١٠٠% مع رش الماء)
- أعطت نباتات الكنترول أعلى قيم لوزن الدرنة والنسبة المئوية للمادة الجافة – وأعطى تداخل الجبريللين مع السماد المشترك ٥٠% بلدى و ٥٠% كيماوى أعلى قيمة للكثافة النوعية في حين أعطت أقل قيم للنسبة المئوية للمادة الجافة والمواد الصلبة الذائبة الكلية.
- أدى استخدام مواد النمو الثلاثة مع التسميد المشترك ٥٠% بلدى و ٥٠% كيماوى إلى زيادة النسبة المئوية للنشا – كما حدثت زيادة في محتوى الدرنات من الأحماض الأمينية عند استخدام السماد المشترك ٢٥% بلدى و ٧٥% كيماوى مع رش النباتات بالماء . كما أدى رش النباتات بالجبريللين مع معاملات التسميد إلى زيادة محتوى الدرنات من النيتروجين والفوسفور .