www.ThePharmaJournal.com
The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(11): 817-821

www.thepharmajournal.com
Received: 23-09-2017
Accepted: 24-10-2017

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Effect of different levels of nitrogen and potassium on the growth and yield of Pepino (*Solanum muricatum* Ait.)

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Abstract
Pepino (*Solanum muricatum* Ait.) has large deposits of vitamin A, C, K and B. It is also rich in minerals such as copper and iron which are essential in blood formation and boosting immunity. Potassium in the fruit helps in lowering blood pressure and improving blood flow and central nervous system coordination. Pepino is also diuretic it accelerates passage of urine, therefore, appropriate for diabetic patients. In this context an investigation was carried out at Experimental Research Farm of SASRD, Medziphema campus, Nagaland University during 2015- ‘016 to study the effect of different levels of nitrogen and potassium on the growth and yield of Pepino (*Solanum muricatum* Ait). Experiment was conducted with 16 treatments and three replication in Randomised Block Design (RBD) with two factors. Each treatment was a combination of one Nitrogen and one Potassium level. The Nitrogen levels were varied 0(N_o), 60(N_1), 80(N_2) and 100(N_3) kg ha^{-1}. The Potassium levels were, supply of Potassium 0(K_0), 30(K_1), 45(K_2) and 60(K_3) kg ha^{-1}. Nitrogen and Potassium showed significant influence on the growth and yield parameter. The obtained result indicated that growth parameter viz., plant height (cm), leaf area (cm^2) per plant, number of branches per plant significantly increase with increase doses of nitrogen up to 100 kg/ha. Fruit per plant, fruit per plot, fruit weight also increase with increased levels of nitrogen and potassium. Potassium also had significant effect on growth parameters. The combination of nitrogen and potassium $N_{100}K_{60}$ treatment (100 kg N +60 kg K/ha) gave best result in growth parameter and yield parameter. Therefore, the result showed that 100 kg N/ha and 60 kg K/ha alone with their combination had influence greatly on vegetative growth and yield.

Keywords: Pepino, nitrogen, potassium, growth parameter, yield

Introduction
Pepino (*Solanum muricatum* Ait.) is an herbaceous plant belonging to the family Solanaceae and native to South America countries (Heiser, 1964 [7]; Sakata, 2011 [14]). Pepino is a little known crop from the tropical and subtropical regions esteemed for its edible fruits, which are aromatic, juicy, scented, having mild soft texture. It is known as "pepino" in Spanish which means cucumber and to distinguish it from cucumber it is named “pepino dulce” which translates as sweet pepino. The fruit resembles a melon in colour, and its flavour recalls a succulent mixture of honeydew and cucumber and thus it is also called pepino melon or melon pear. The pepino was widely introduced to Europe in the 18th century spreading from Spain and has been growing in the states of California and Florida since late 19th century. It has become commercial crop in New Zealand, Chile and California and is especially popular in Japan. In India it was introduced only in 1980s. Although it has been a neglected crop for a long time, there is an increasing interest for this fruit from European, Japanese and United States market (Gonzales *et al*., 2000) [6].
Pepino is a self-fertile and fruit matures 40-45 days after flowering. Pepino fruit are round to elongate in shape can weigh from 100 to 500g at maturity and contain 6-12% soluble solids. The pepino is said to have some medicinal properties. It is a good anti scorbutic, since it contains vitamin C (25-70 mg/100 ml) at higher levels than normally found in most fruits. The popularity of this fruit in local and national market is due to versatile nature of its use. It can be consumed in different ways depending on its maturity. When ripe (50-55 DAF), it is consumed as a refreshing dessert fruit, or as an ingredient of fruit salads, for preparing juices, preserves, ice-creams and jams (Morley-Bunker, 1983) [11]. When it is in mature but unripe stage it can be used as vegetable in stews (Esquivel and Hammer, 1991) [4].
Nutrients play an important role in improving productivity and quality of crops. Adequate supply of nutrient can increase the yield, fruit quality, fruit size, colour and taste of fruit.

Nitrogen is a major limiting nutrient in crop production. It can be applied through chemical or biological means. The amount of nitrogen required by the plant comparatively larger than other elements (Marschner, 1995) [10]. Adequate nitrogen promotes vegetative growth providing sufficient photosynthetic area which in turn promotes flowering and fruit set studies show that nitrogen and potassium have a key role in the plant growth and development of tomato and is recommended to apply during growing stage of the crop while phosphorus is needed after transplanting (Arya *et al*., 1999) [2]. Phosphorus promotes root development and more vigorous growths especially of young plants. Potassium plays a key role in many physiological and biochemical processes such as enzyme activation, metabolism of carbohydrate and protein compounds. Pepino has been found growing in the north eastern states in the sub-tropical region up to an altitude of 1000 m above mean sea level. There may be several factors for such poor performance where good management practices in the farmers' field may also be one reason for the decline in the production of this crop. As such there is a felt need to evaluate the nutrient management system in this crop in order to improve the production of pepino as it has good marketing scope. Therefore, the present investigation entitled "Effect of different levels of nitrogen and potassium on the growth, yield and leaf nutrient content of pepino (*Solanum muricatum* Ait.)" was undertaken.

Material and Methods

Experiments was conducted at School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema Campus during 2015-2016 to Effect of different levels of nitrogen and potassium and their interaction on growth and yield of pepino (*Solanum muricatum* Ait.). located at the foothill of Nagaland at Medziphema at an altitude of 304.8 m above mean sea level and geographically positioned at 25^0 45'43" N Latitude and 93^0 53' 04" E longitude. The mean temperature ranges from 21 to 30 °C and the maximum temperature does not go beyond 35 °C in summer and 10 to 20 °C in winter which rarely goes below 6 °C. It receives annual rainfall ranging from 1500-2500 mm annually. Its comes under sub-tropical climate with moderate temperature, hot and humid summer while in winter it is cool and dry. The mean temperature ranges from 21 to 30 °C and the maximum temperature does not go beyond 35 °C in summer and 10 to 20 °C in winter which rarely goes below 6 °C. It receives annual rainfall ranging from 1500-2500 mm annually.

The study was conducted with 16 treatments and three replication in Randomised Block Design (RBD). Each treatment was a combination of one Nitrogen and one Potassium level. The Nitrogen levels were varied $0(N_o)$, $60(N_1)$, $80(N_2)$ and $100(N_3)$ kg ha^{-1}. The Potassium levels were, supply of Potassium $0(K_0)$, $30(K_1)$, $45(K_2)$ and $60(K_3)$ kg ha^{-1}.

The soils of the experimental site was found to be acidic in nature (pH- 4.4) and high in organic carbon (1.56%) with medium content of available N (388.87 Kg/ha), K (215.04 Kg/ha) and P (40.41 Kg/ha). The plant materials of Pepino were collected from SASRD, NU, Medziphema Campus. These plants were propagated by cuttings with 3 or 4 nodes (5cm in length) and raised in polyethylene bags filled with a rooting medium of soil: FYM: sand in the ratio 1:1:1. The cuttings become ready for transplanting after one month. The total number of plots 48, plot size (2m × 2 m) and maintaining spacing (60cm × 60cm) each plot having 16 numbers of plants.

Results and Discussion

Growth parameters

The data observed on plant height (cm) and number of branches per plant at 30 DAT, 60 DAT and 90 DAT for the effect of different levels of nitrogen and potassium and their interaction on pepino (*Solanum muricatum* Ait.) are depicted in table 1. It was observed that the significant differences in the maximum plant height (26.81 to 55.00 cm from 30 to 90 DAT) was recorded with application of 100 kg N /ha while minimum (19.98 to 39.70 cm from 30 to 90 DAT) was recorded with control plants. The different levels of potassium also had significant effect on plant height at all days of observation. The maximum plant height (25.67 to 51.62 cm from 30 to 90 DAT) was recorded in with 60 kg K /ha closely followed by the treatment of 45 kg K/ha (24.23 to 49.06 cm from 30 to 90 DAT) which were statistically at par. The minimum plant height (20.88 to 39.70 cm from 30 to 90 DAT) was recorded with control plant on all days of observation. The application of $N_{100}K_{60}$ showed greatest plant height (28.08 to 64.34 cm from 30 to 90 DAT) on all days of observation while the minimum (14.17 to 33.34 cm from 30 to 90 DAT) was recorded in control plant (N_0K_0).

There was increased in plant height with increased levels of nitrogen and potassium. Bhuvaneswari *et al*. (2013) [3] on chilli who reported that application of different levels of nitrogen and potassium had significant influence on plant height of where the maximum plant height at final harvest was obtained from N_3K_2 treatment (75 kg N + 60 kg K/ha. The increase in plant height in response to increased application of nitrogen could be attributed to enhanced synthesis of protein in the plant, which were the fundamental building material of cells and a constituent of most enzymes. Thus, the protein is involved in metabolic processes throughout the plant; as a result of which the plants grow vegetative and luxuriously in response to increased application of nitrogen fertilizer. Potassium plays a role in functioning of enzymes needed for growth and development of plant also helps in nitrogen uptake which results in better vegetative growth.

The data on number of branches per plant at 30 DAT, 60 DAT and 90 DAT observed that significant difference in the maximum number of branches (6.61 to 13.58 from 30 to 90 DAT) was recorded with 100 kg/ha of N and the minimum (3.83 to 7.05 from 30 to 90 DAT) was recorded with control plant. The different levels of potassium also had significant influence on the maximum number of branches (5.92 to 13.58 from 30 to 90 DAT) were recorded from the highest dose of potassium 60 kg/ha followed by 45 kg of potassium (5.75 to 11.10 from 30 to 90 DAT) which were statistically at par. The minimum number of branches (5.13 to 10.15 from 30 to 90 DAT) per plant was observed in control plot. The interaction of nitrogen and potassium levels on the application of $N_{100}K_{60}$ showed significantly best performance over other treatments in the number of branches in all days of observation (7.75 at 30 DAT, 11.33 at 60 DAT and 16.67 at 90 DAT). The minimum number of branches 2.67 to 5.50 at 30 to 90 DAT was observed with control plants. The results find similarity with those of Iqbal *et al.* (2011) [8] who observed the greatest number of branches per plant in tomato with the application of 60:0(N: K) kg/ha. The present finding found similar with these reports on the number of branches per plant as affected by different N and K levels. The number of branches per plant is of considerable importance and it has positive association with flowering and yield.

The data recorded on leaf area (cm^2) per plant at 50% flowering depicted in figure 1. The highest leaf area (25.22 cm^2) was recorded with application of 100 kg N/ha followed by 80 kg/ha N (23.77 cm^2). The different level of potassium had no-significant effect on leaf area. The maximum leaf area was found highest (24.40 cm^2) with the application of 60 kg K/ha closely followed by 30 kg K/ha (21.35 cm^2) and control plant (21.35cm^2). The minimum leaf area (20.98 cm^2) was observed with 45 kg K/ha. The interaction of nitrogen and potassium showed significantly influence on leaf area. The application of $N_{100}K_{60}$ showed its superiority over other treatments in increasing the average leaf area. The maximum leaf area (30.21 cm^2) was recorded with $N_{100}K_{60}$ (100 kg N + 60 kg K /ha) and minimum was recorded with (21.74 cm^2) N_0K_0 treatment. The results inferred the present findings are in agreement with the finding of Nafiu *et al.* (2011) [12] who observed in egg plant and stated that the leaf area for all the treated plants performed better than the control and fertilizer dose with 200 kg NPK/ha gave highest leaf area.

Yield and yield attributes

The data presented on table 2 showed significant effect of different levels nitrogen and potassium on the number of fruits, Yield per plant and per plot at all days of observation. The maximum number of fruits per plant, Yield per plant and per plot (8.45, 0.96 kg and 15.34 kg) was observed with the application of 100 kg N /ha followed by the 80 kg N/ha (5.24, 0.73 kg and 11.68 kg) respectively, while minimum number of fruit per plant, Yield per plant and per plot (3.59, 0.42 kg and 6.65 kg respectively) were recorded from controls plants. The different levels of potassium also have significant effect on the number of fruits per plant, Yield per plant and per plot. The more number of fruit per plant, Yield per plant and per plot (6.44, 0.85 kg and 13.59 kg) respectively, while minimum was recorded with the control plants. The different levels of potassium also had significant influence on the yield. The maximum yield per plant and per plot (0.85 and 13.59 kg) was recorded with the highest dose of potassium 60 kg K ha^{-1} while minimum (0.53 and 8.50 kg respectively) was recorded with control plants. The projected yield also followed similar trend were the highest dose of potassium 60 kg/ha with yield (339.82q/ha).The minimum (212.75q/ha) projected yield was recorded with K_0 (control).

The present finding is in accordance with the findings of Ahmed and Butt (1999) [1] who reported that number of fruits per plant was increased with increased level of N. The result are also in agreement with those of Roychaudhury *et al.* (1995) [13] who reported that number of fruit per plant increased with increasing levels of nitrogen. Similar finding was observed by Bhuvaneswari *et al.* (2013) [3] who stated that maximum number of fruit per plant was found with the treatment combination of 75 kg N + 60 kg K/ha.

From the present investigation it was observed that application of 100 kg N/ha and 60 kg K /ha gave the highest yield per plant, yield per plot as well as projected yield. Increased in foliage indirectly increased the photosynthesis and thus ultimately increased the yield. Fandi *et al.* (2010) [5] who observed that increasing N (200 ppm), P (100 ppm) and K (300 ppm) concentrations in the nutrient solution over the control nutrient solution resulted in more total yield (chilli). Similarly, Kumar *et al.* (2013) [9] on tomato observed fruit yield/plant, fruit yield/ha were obtained from the application of the recommended dose of nutrients viz., 120 kg N +80 kg P +75 kg K. The higher yields were probably responsible for better development of fruit, increased uptake of nutrients in the plants leading to enhanced chlorophyll content and carbohydrate synthesis, higher accumulation of photosynthesis and their distribution to the developing ovules. The increase in yield with application of plant nutrients could be reason in developing greater size fruit enhancing the yield in plant.

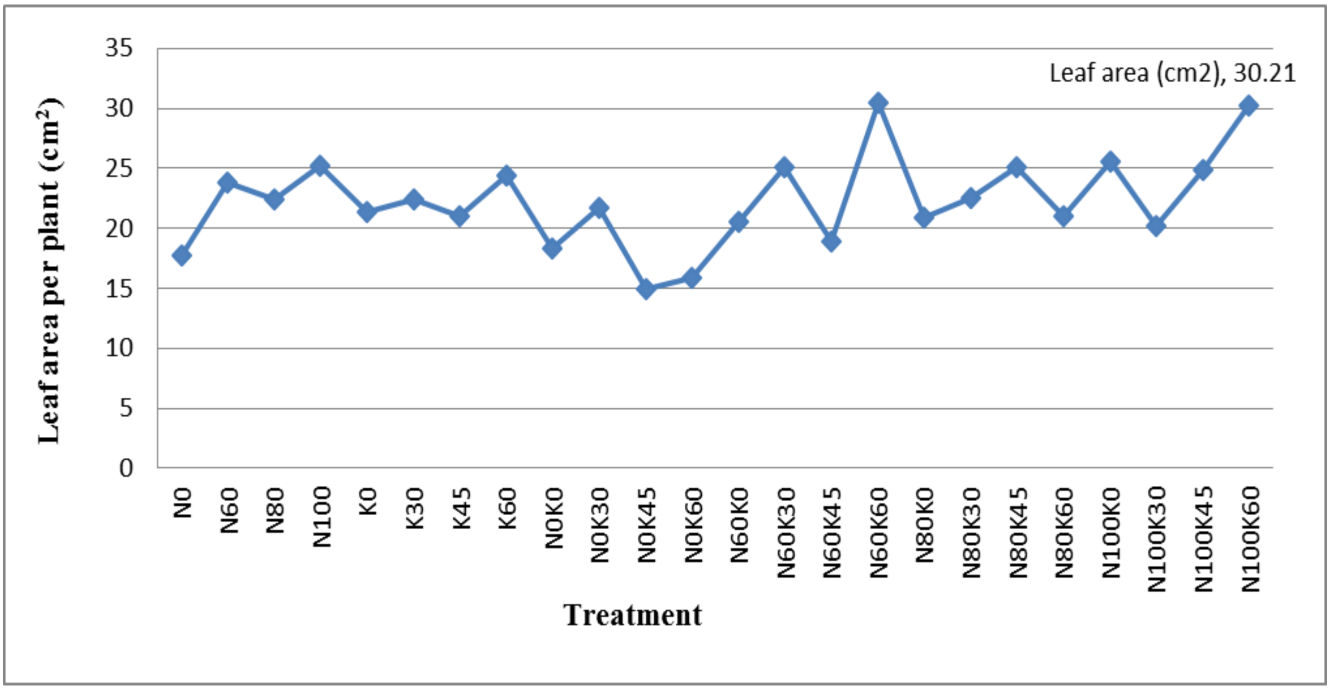

Fig 1: Effect of different levels of N and K and their interaction on leaf area at 50% flowering.

Table 1: Effect of different levels of N and K and their interactions on plant height (cm) and number of branch per plant of Pepino (*Solanum muricatum* Ait.)

Treatment	Plant height (cm)			Number of branch per plant		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
N_0	19.98	29.21	39.7	3.83	5.41	7.05
N_{60}	22.77	35.1	44.72	5.77	7.35	11.45
N_{80}	23.65	37.25	49.06	6.11	7.71	11.94
N_{100}	26.8	43.02	55	6.61	9.73	13.58
S Em±	0.59	0.62	0.61	0.2	0.26	0.4
CD at 5%	1.72	1.8	1.77	0.59	0.77	1.16
K_0	20.88	34.11	39.7	5.13	7.00	10.15
K_{30}	22.44	35.7	44.72	5.52	7.23	10.78
K_{45}	24.23	36.31	49.06	5.75	7.64	11.1
K_{60}	25.67	38.46	51.62	5.92	8.33	13.58
S Em±	0.59	0.62	0.61	0.2	0.26	0.4
CD at 5%	1.72	1.8	1.77	0.59	0.77	1.16
Interaction N x K						
N_0K_0	14.17	26.42	33.34	2.67	4.25	5.5
N_0K_{30}	17.17	27.09	37.67	3.75	6.0	6.97
N_0K_{45}	23.58	31.08	42.33	4.55	5.9	8.95
N_0K_{60}	24.98	32.25	45.5	4.33	5.5	6.78
$N_{60}K_0$	21.5	33.0	41.5	5.17	5.67	9.68
$N_{60}K_{30}$	24.16	34.67	44.67	5.83	7.0	12.35
$N_{60}K_{45}$	21.25	35.83	45.75	6.63	8.4	11.5
$N_{60}K_{60}$	24.17	36.92	47.0	5.44	8.33	12.25
$N_{80}K_0$	21.83	37.0	47.58	6.25	8.67	11.73
$N_{80}K_{30}$	21.91	37.67	48.67	6.1	6.67	11.83
$N_{80}K_{45}$	25.41	38.0	50.33	5.92	7.33	11.92
$N_{80}K_{60}$	25.46	36.0	49.55	6.17	8.17	12.27
$N_{100}K_0$	26.0	40.03	50.0	6.42	9.42	13.67
$N_{100}K_{30}$	26.5	43.4	54.0	6.4	9.24	11.97
$N_{100}K_{45}$	26.67	41	51.67	5.88	8.91	12.03
$N_{100}K_{60}$	28.09	48.34	64.34	7.75	11.33	16.67
SEm ±	1.19	1.25	1.23	0.41	0.53	0.8
CD at 5%	3.44	3.6	3.56	1.19	1.54	2.32

Table 2: Influence of different levels of N and K and their interaction on number of fruits, yield and projected yield

Treatment	Fruit/plant	Yield/plant (kg)	Yield/plot (kg)	Projected yield(q/ha)
N_0	3.59	0.42	6.65	166.56
N_{60}	3.87	0.61	9.72	242.98
N_{80}	5.24	0.73	11.68	291.92
N_{100}	8.45	0.96	15.34	383.48
S Em±	0.27	0.02	0.29	7.31
CD at 5%	0.78	0.05	0.84	21.11
K_0	4.30	0.53	8.50	212.75
K_{30}	5.00	0.65	10.43	260.68
K_{45}	5.40	0.68	10.87	271.68
K_{60}	6.50	0.85	13.59	339.82
SEm±	0.27	0.02	0.29	7.31
CD at 5%	0.78	0.05	0.84	21.11
Interaction N xK				
N_0K_0	3.17	0.32	5.04	126.93
N_0K_{30}	3.67	0.43	6.85	171.22
N_0K_{45}	3.70	0.43	6.88	172.00
N_0K_{60}	3.83	0.49	7.84	196.08
$N_{60}K_0$	3.63	0.36	5.69	142.33
$N_{60}K_{30}$	3.67	0.61	9.82	245.43
$N_{60}K_{45}$	3.90	0.64	10.25	256.13
$N_{60}K_{60}$	4.28	0.82	13.12	328.00
$N_{80}K_0$	4.10	0.61	9.72	243.07
$N_{80}K_{30}$	4.97	0.70	11.21	280.13
$N_{80}K_{45}$	5.67	0.73	11.73	293.27
$N_{80}K_{60}$	6.23	0.88	14.05	351.20
$N_{100}K_0$	6.33	0.85	13.55	338.67
$N_{100}K_{30}$	7.70	0.86	13.84	345.93
$N_{100}K_{45}$	8.33	0.91	14.61	365.33
$N_{100}K_{60}$	11.42	1.21	19.36	484.00
SEm±	0.54	0.04	0.58	14.62
CD at 5%	1.57	0.11	1.69	42.23

Conclusion

Effect of nitrogen could be attributed to enhanced protein synthesis in plant, which is the fundamental building material of cells and a constituent of most enzymes. Thus, the protein is involved in metabolic processes throughout the plant; as a result of which plants vegetative growth increase in application of nitrogen fertilizer. Potassium plays a role in functioning of enzymes needed for growth and development of plant also helps in nitrogen uptake which results in better vegetative growth. Application of different level of nitrogen and potassium significantly influenced the growth and yield of Pepino in terms of plant growth parameter viz., plant height, number of branches, leaf area and also yield per plant. So the best treatment were with application of 100 kg N and 60 kg K/ha which can be recommended for the cultivation of Pepino in order to obtain good production.

References

1. Ahmed CMS, Butt SJ. Effect of NPK on some yield components of tomato. Anadolu. 1999; 9(1):56-62.
2. Arya PS, Vidyasagar, Singh SR. Effect of N, P and K on tomato seed production. Science of Horticulture. 1999; 6:89-91.
3. Bhuvaneswari G, Sivaranjani R, Reeth S, Ramakrishnan K. Application of Nitrogen and Potassium efficiency on the growth and yield of chilli *Capsicum annuum* L. International Journal of Current Microbiology and Applied Science. 2013; 2:329-337.
4. Esquivel M, Hammer K. The cultivated spices of the family Solanaceae iii: Taxonomy, chemistry, evalution. Eds JG, Hawkes RN, Lester M Nee, N Estrada. Royal Botanic garden Kew and linnean society of London. 1991, 357-364.
5. Fandi M, Muhtaseb J, Hussein M. Effect of N, P, K concentration on yield and fruit quality of tomato (*Solanum lycopersicum* L.) in tuff culture. Journal of Central European Agriculture. 2010; 11(2):179-184.
6. Gonzales M, Camara M, Prohens J, Ruiz JJ, Torija E, Nuez F. Colour and composition of improved pepino cultivars at three ripening stages. Gartenbauwissenschaft. 2000; 65:83-87.
7. Heiser CB. Origin and variability of the pepino (*Solanum muricatum*): A preliminary report. Baileya. 1964; 12:151-158.
8. Iqbal M, Niamatullah M, Yousaf I, Munir M, Khan MZ. Effect of nitrogen and potassium on growth, economical yield and yield components of tomato. Sarhad journal of agriculture. 2011; 27:4.
9. Kumar M, Meena ML, Kumar S, Maji S, Kumar D. Effect of nitrogen, Phosphorus and potassium fertilizers on the growth, yield and quality of tomato var. Azad T-6. Asian Journal of Horticulture. 2013; 8:616-619.
10. Marschner H. Mineral nutrition of higher plants 2nd edition Academic. Press. London, New York, 1995.
11. Morley–Bunker MJS. Anew commercial crops, the pepino (*Solanum muricatum* Ait) and suggestion for further development. Annual Report, Royal New Zealand Institute of Horticulture. 1983; 11:8-19.
12. Nafiu, Kehinde A, Togun, Adeniyi O, Abiodun, Olabiyi M, *et al*. Effects of NPK fertilizer on growth, dry matter production and yield of eggplant in South Western Nigeria. Agriculture and Biology Journal of North America. 2011; 2:1117-1125.
13. Roychaudhury A, Chatterjee R, Mitra SK. Effect of

different doses of nitrogen, phosphorus, potassium, magnesium, calcium and iron on growth and development in chilli. Department of Horticulture Kalyani West Bengal, India. 1990-1995; 13:96-99.

14. Sakata Y. In: Nosangyosonbunkakyokai (ed.). Encyclopedia of growing vegetables 20. 2nd ed. (In Japanese). Nosangyosonbunkakyokai, Tokyo. Pepino. 2011, 305-309.