International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

The Influence of the Nutritional Condition of Papaya on the Development and Productivity of Plants

Adilov Hikmatilla Abdukhalilovich

The Independent Researcher of Horticulture and Viticulture Department, Tashkent State Agrarian University, 100140, University str., 2, Kibray district, Tashkent region, Uzbekistan

Abstract: ***The complex of external conditions (aeration, nutrition and moisture provision) have a huge impact on the size of the root system, the nature of its placement along the soil horizons and an active aboveground part formation, capable of maximally nutrients usage. The interaction of the root system with the environment, its absorption of nutrients from the soil is an active physiological process connected with the vital activity of the whole organism. A big role in this process belongs to agro technical methods and, above all, the introduction of fertilizers that contribute to the creation of a powerful absorbing surface of the roots, which is extremely important for the mineral nutrition of plants. The results of the research on the main types of macro-fertilizers usage (NPK-Nitrogen-Phosphorus-Potassium) when growing papaya (melon tree) on intensive technology in greenhouse conditions were given in this article. It was established by the research, that the best conditions for the development of the root and above-ground system of plants are created when N140 P70 K35 kg/ha is applied to the soil annually. Under these conditions, two years old plants form up to 22-23 fruits with a total yield of 117.52-122.65 t / ha.***

Keywords: papaya, fertilizers, norm, root system, growth, development, generative organs, harvest

1. Introduction

Currently, papaya (*Sarica papaya* L.) is grown on an industrial scale in many foreign tropical countries - Brazil, Mexico, Bolivia, Peru, Indonesia, Malaysia, Australia, etc. Papaya yields a record among all fruit plants. The yield of this fruit crop can reach 150 t/ha [1, 5].

Papaya fruits and leaves are widely used in the treatment of many diseases of the digestive tract - ulcer, colitis, gastritis, reduce insulin need in diabetes, help to reduce the acidity of gastric juice. The protein enzyme papain (protease) containing in fruits, which is very close to human stomach pepsin, can soften and improve the digestibility of protein foods. Medical preparations made from fruits and leaves are effective in treating cancer diseases of lungs, liver, pancreas, actively excrete radionuclides from the human body and improve the general health of the person [6].

The theory of plant nutrition is inseparably linked not only with the increase of harvest quantity, but also its quality. Changes in plant nutrition lead to a change in crop structure. Applying a certain combination of nutrients and different methods of fertilizer application, can cause such direction of metabolism in the plant, which will lead not only to the increase of yield, but also to change of its quality.

2. Methods of research

Solo variety of papaya was used in the research. The rates of main mineral fertilizers application (*NPK*-Nitrogen-Phosphorus-Potassium) were made based on the generally accepted ratio for fruit crops 1:0.5:0.25 [2, 3, 4].
The experience was laid as follows:

1) $N_{80}\ P_{40}K_{35}$
2) $N_{100}P_{50}\ K_{25}$
3) $N_{120}\ P_{60}\ K_{30}$ - control
4) $N_{140}\ P_{70}\ K_{35}$
5) $N_{160}\ P_{80}\ K_{40}$

3. Results and discussion

The study of the influence of fertilizer types on the growth dynamics of active roots has shown that the greatest effect from their use is manifested when nitrogen fertilizer is applied. When phosphorus was added to one linear meter of the root system, 46 points of growth were formed. In relation to the control it was 145%. Less active roots are formed by fertilizing plants with potassium alone - 128%. Papaya responds best to nitrogen-phosphorus nutrition out of the paired combinations of fertilizers. The reaction of active roots to the nitrogen-potassium and phosphorus-potassium combination is very close and significantly inferior to the nitrogen-phosphorus mixture. The average number of developed points of growth per 1 meter of the root for these combinations made 147, 163 and 143%, respectively, relative to the control (Table 1).

Table 1: The formation of active roots in Solo papaya variety, depending on the nutrients introduced into the soil

Experiment variants	Average length of an active root, mm	The number of growth points for 1 linear metres of root	The amount of growth points	
			pcs.	% to the control
Control-without fertilizers	0,7	25	515	100,0
N_{120}	0,8	52	863	157,5
P_{90}	0,8	46	751	145,8
K_{30}	0,8	40	661	128,3
$N_{120}P_{60}\ K_{30}$	0,9	50	819	159,0
$N_{80}\ P_{40}K_{35}$	0,8	48	740	143,6
$N_{100}P_{50}\ K_{25}$	0,8	48	758	147,1
$N_{140}\ P_{70}K_{35}$	1,6	59	98	191,0
$N_{160}P_{80}K_{40}$	1,9	71	1011	196,3

The effective growth and development of the above-ground skeletal parts of Solo papaya variety, as expected, caused by high rates introduction of mineral fertilizers. The best conditions for the development of the above mentioned structural parts of papaya were observed in the variants of soil fertilization of the plantation at the rate of N_{140} P_{70} K_{35} and N_{160} P_{80} K_{40} kg/ha. In these variants of the experiments, the development of Solo papaya variety was approximately the same, therefore the optimum rate of fertilization could be N_{140} P_{70} K_{35} kg/ha.

The complex introduction of the main types of mineral fertilizers improved the degree of nutrients absorption starting from the moment of their application and during the whole vegetation period of the plant. Under these conditions of nutrient agro background (soil fertility) experimental plants at six months formed from 10 to 14 leaves on the central stem, from 12 to 27 leaves on the lateral shoots.

Optimization of the nutritional conditions of Solo papaya variety influenced both the development of the root and aboveground parts of plants and the formation of generative organs. From the data in Table 2 and Figure 1, it is clear that the conditions of nutrient optimization have a positive effect on the formation of flowers in the aerial parts of plants.

Table 2: The formation of the generative organs of Solo papaya variety

Experiment variants	Generative organs on plants, pcs				
	Flowers in all	hermaphrodites	Females	males	fruits
Control-without fertilizers	32,9	10,3	9,0	16,3	18,2
N_{80} P_{40} K_{15} kg/ha	38,7	13,9	18,1	10,8	26,0
N_{100} P_{50} K_{25} kg/ha	44,5	18,2	19,1	10,9	37,1
N_{120} P_{60} K_{30} kg/ha (control)	69,5	29,4	31,3	12,5	60,3
N_{140} $P_{70}0$ K_{35} kg/ha	81,7	32,5	34,6	14,8	70,9
N_{160} P_{80} K_{40} kg/ha	85,6	34,8	38,0	12,5	74,5

In the majority of such plants significantly increase the proportion of female and hermaphroditic flowers - from 71 to 82%. The proportion of male flowers in plants grown using different rates of mineral fertilizers ranged from 18 to 29%. The use of various types and norms of mineral fertilizers has changed the number of fruits formed on individual plants.

Figure 1: Formation of papaya fruits of Solo variety at eight months in application of $N_{140}P_{70}K_{35}$ kg/ha to the soil.

Most of fruits during the experiment were formed on plants grown on the background of N_{140} P_{70} K_{35} kg/ha - 22 pieces. In the control variant, this figure was 6 fruits, that is, 3.5–4.0 times less. The total yield according to mineral fertilizer application variants was respectively: in the control variant - 13.3 t/ha, N_{80} P_{40} K_{15} kg/ha - 29.33 t/ha, N_{100} P_{50} K_{25} kg/ha - 49.77 t/ha, N_{120} P_{60} K_{30} kg/ha - 75.99 t/ha, N_{140} P_{70} K_{35} kg/ha - 117.32 t/ha, N_{160} P_{80} K_{40} kg/ha - 122.65 t/ha (Table 3).

Table 3: The productivity of two-year-old papaya plants, depending on the rates of mineral fertilizers application

Experiment variants	The number of fruits on 1 plant, pcs	Fruit weight, kg	Yield from 1 plant, kg	Yield, t/ha
Control-without fertilizers	6	0,5	3,0	13,33
N_{80} P_{40} K_{15} kg/ha	11	0,6	6,6	29,33
N_{100} P_{50} K_{25} kg/ha	16	0,7	11,2	49,77
N_{120} P_{60} K_{30} kg/ha (control)	19	0,9	17,1	75,99
N_{140} $P_{7}0$ K_{35} kg/ha	22	1,2	26,4	117,52
N_{160} P_{80} K_{40} kg/ha	23	1,2	27,6	122,65
$Sx_{average}$, t/ha				5,73

Note: the planting scheme is 1.5 x 1.5 m, i.e. 4444 pcs/ha.

4. Conclusions

1) The optimal rate of mineral fertilizers application in papaya growing is N_{140} P_{70} K_{35} kg/ha, in which the six-year-old plant reaches 155-160 cm. in height, with a cropped lateral shoots up to 47 cm in height and leaves in the number of 39 to 42 per plant.
2) In plants, grown under well supplied level of nutrition during vegetation are formed from 71 to 82% of female and hermaphrodite types of flowers in the aboveground part, and the portion of male ones reduces, while in plants on the unfertilized background the portion of latter ones reaches 47%.
3) When growing Solo papaya sort on the background of mineral fertilizers application at the rate of N_{140} P_{70} K_{35} kg/ha, plants of two years old begin fruiting in the number of more than 22 pieces, 8 pieces on the unfertilized background, with a total yield up to 122.65 t/ha.

References

[1] Brezhenev D.D. (1974). Plant breeding of Australia. Moscow: Kolos. P. 314-319.
[2] Buriev Kh.Ch., Enileev N.Sh. (2014). Methods of calculation and phonologic observations during experiments with fruit and berry plants. Tashkent. P. 15-25.
[3] Dospekhov B.A. (1973). Methods of field experiment. Moscow: Kolos. P. 202-204; 231-232; 232-237.
[4] Molostov A.S. (1966). Methods of field experiment. Moscow: Kolos. P.235-237.
[5] Nagorny V.D. (1985). Fertilization system of subtropical cultures. Manual. Moscow: UDN. 76 p.
[6] Penziev A.M. (1986). Papaya in Turkmenia. Journal of Agriculture of Turkmenistan, №6. P.35.