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Effect of Nitrogen and Potassium on Early Growth of Jatropha (Jatropha curcas)

Bustanul Arifin
Fakultas Pertanian, Univeritas Brawijaya, Malang, Indonesia

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ABSTRACT

Jatropha curcas is a plant from the Euphorbiaceae family which has the potential for medicinal plants and as a renewable energy source. The production and process of seed and fruit formation is highly dependent on environmental genetic factors, agronomy and the interaction between these factors. The quality of the initial growth of the plant is one of the factors that determine the level of production of Jatropha. The aim of this study was to determine the effect of different levels of N and K fertilizer on the initial growth of Jatropha curcas and to obtain the optimal dose. The hypothesis put forward is that there is an interaction of N and K between the application of nitrogen fertilizers and potassium fertilizers on the initial growth of jatropha and rapid growth of jatropha is obtained by providing the highest levels of N and K. The results showed that N application of 40 kg N/ha and without K had the best effect on the initial growth of jatropha compared to other treatments. Meanwhile, the addition of N and K levels had an effect on decreasing the growth of jatropha even though the total N and K content of leaves was high, because high levels of N and K fertilization caused poisoning and salt stress in plants due to the very high status of K content in the soil.

Corresponding Author:

Bustanul Arifin,
Fakultas Pertanian, Univeritas Brawijaya,
Jl. Veteran, Ketawanggede, Kec. Lowokwaru, Kota Malang, Jawa Timur 65145
Email: arifinbustanul@gmail.com

1. INTRODUCTION

Fuel oil (BBM) in Indonesia in 2005 induced by rising world fuel prices has made Indonesia need to look for alternative sources of renewable energy that might be developed in Indonesia. One of the plants that has the potential as a source of fuel or a renewable energy source is the Jatropha curcas (Jatropha curcas) because the vegetable oil from the Jatropha plant can be processed into a substitute fuel for petroleum or a substitute for fossil energy (diesel, kerosene, and oil). burn).

Jatropha leaves can be used to treat swelling due to being hit, sprains, broken bones, bleeding wounds, itching, eczema, fungus between the toes. In addition, it is also used to prevent colds for babies, treat leprosy, gonorrhea, rheumatism, worm medicine and to nourish hair. Castor fruit and seeds are used to treat chronic ulcers, rheumatism, and to get rid of dandruff. The sap is used to treat ulcers, scabies, eczema, constipation and toothache.

Nitrogen is generally needed for the formation or growth of vegetative parts of plants such as leaves, stems and roots, but if too much can inhibit flowering and fruiting in plants. Many studies have been carried out to determine the optimum dose of nitrogen fertilizer for various types of plants, especially oil-extracted plants. the seeds. All studies demonstrated that nitrogen application

resulted in markedly increased yields under various plant growth conditions. Potassium is one of the 3 essential nutrients for plants which has a major influence on the optimum dose of nitrogen.

Besides functioning to control the enzyme system that determines the rate of photosynthesis and respiration, carbohydrate metabolism and translocation of organic acids in plants, the provision of potassium in nutrient media has a major effect on the level of nitrate uptake where the provision of potassium increases nitrogen uptake.

Uptake of nitrate and its assimilation in protein is influenced by potassium. The yield of plant dry matter is obtained from high nitrogen fertilization and sugar production is influenced by sufficient levels of potassium content (Foth, 1998). Research in Canada on barley (a type of wheat) grown hydroponically showed that at low K levels, increasing the dose of N added reduced crop yields. At medium K concentrations, the highest N values did not decrease or increase yield levels either.

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2. METHOD

2.1 Types of research

type of quantitative research by processing secondary and primary data. Primary data that has been previously processed using tools.

2.2 Research variable

The variable used is the intervening variable with the intervening variable being the number of seeds in one jatropha fence.

2.3 Research design

This study used a factorial randomized block design (RBD) method with 2 factors and 3 repetitions. The first factor was nitrogen fertilizer using urea fertilizer and the second factor was potassium fertilizer using KCL fertilizer.

2.4 Sampling Locations.

This study used 6 plant samples. So that the total number of experimental samples is 270 plant samples.

2.5 Time and Location of Research

The research was conducted between January - May 2007 in a house yard located on Jl Tlogo Indah, Tlogomas Village, Kodya Malang with an altitude of 500 m above sea level.

2.6 Tools and materials

The tools used are hoes, analytical scales, trowels, ovens, meters, calipers, bellows and digital cameras and the materials needed are jatropha seeds, manure, polybags, plastic ice, katel, urea, KCL and SP-36.

2.7 Research procedure

This research begins with preparing all the tools and materials along with the available data and then testing them using tools to produce accurate conclusions.

2.8 Data Analysis.

The data obtained from the observations were then analyzed using the F test at the 5% level if there was a significant effect, then it was continued with the Duncan test at the 5% level.

3. RESULTS AND DISCUSSION

3.1 Research result.

The results of the analysis of variance showed that there was no significant interaction between nitrogen and potassium levels on plant height at all ages of observation. Analysis of variance showed that the effect of nitrogen and potassium on plant height at 60 dap was significant at the 5% level and at 75 and 90 dap had a significant effect at the 1% level. Giving nitrogen of 80 kg N/ha and 120 kg N/ha reduced plant height when compared with the application of nitrogen

doses of 40 kg N/h. (N3), moderate nitrogen administration (N2) was not significantly different from the N1 and N3 treatments. At the age of 90 DAP, increasing the dose of nitrogen and potassium actually reduced the height of the jatropha plant. Application of low doses of nitrogen (40 kg N/ha) showed the best results and was significantly different from moderate nitrogen (N2) and high nitrogen (N3) treatments.

Table 1. Average Plant Height From 15 – 90 DAP

Treatment	Plant height					
	15 hst	30 hst	45 hst	60 hst	75 hst	90 hst
40 kg N/ha	9.94	21.13	27.25	36.24b	44.31b	55.55b
80 kg N/ha	10.42	20.53	25.82	34.29ab	42.64a	52.88b
120 kg N/ha	10.19	19.65	25.59	33.58a	40.61a	
Duncan 5%	mr	mr	mr			
0 kg K2O/ha	9.74	20.40	26.57	36.89b	45.75b	57.65c
40 kg K2O/ha	10.6110.10	20.38	26.03	34.56b	42.64a	52.88b
80 kg K2O/ha	10.18	20.59	26.32	33.74a	42.11a	51.19ab
120 kg K2O/ha	10.27	19.85	25.59	33.26a	40.27a	47.24a
160 kg K2O/ha		2096	26.60	34.71a	41.18a	48.04a
Dulcan 5 %	mr	mr	mr			
KK	11,614	8,832	8,320	6,411	6,632	8,246

Note: the numbers in the column followed by the same letter are not significantly different at the 5% Duncan test level, tn = not significantly different, hst = days after planting.

Apart from the plant height, nitrogen also affects plant length. The results of the analysis of variance showed that there was a significant interaction at the 5% level between the application of nitrogen (N) and potassium (K2O) to the length of Jatropha curcas at the age of 60 HST. At the age of 15, 30, 75 and 90 dap there was no interaction between the respective treatments the level of nitrogen and potassium level and there was a significant interaction between the provision of nitrogen and potassium on the width of the plant canopy at the 5% level for the 75th plant age and at the 1% level for plant age 90 hst. Whereas at the ages of 15, 30, 45 and 60 DAP there was no interaction between each treatment of nitrogen levels and potassium levels.

Table 2. Average Plant Length from 15 hst – 90 hst

Treatment	Plant height				
	15 hst	30 hst	45 hst	75 hst	90 hst
40 kg N/ha	16.87	29.04	34.05	53.04b	64.19b
80 kg N/ha	17.37	28.41	32.95	49.90a	58.59a
120 kg N/ha	17.31	27.55	32.61	48.49a	55.28 a
Duncan 5%	mr	mr	mr		
0 kg K2O/ha	16.72	27.72	33.50	53.32b	66.86c
40 kg K2O/ha	17.22	28.53	32.75	50.19 a	60.61b42
80 kg K2O/ha	17.40	28.45	33.57	49.91 a	58.95 ab
120 kg K2O/ha	17.18	27.67	32.25	49.09 a	55.45ab
160 kg K2O/ha	17.38	29.29	33.94	49.89 a	54.88 a
Dulcan 5 %	mr	mr	mr		
KK	9,454	7,789	6,920	5,915	8,763

Note: the numbers in the column followed by the same letter are not significantly different at the 5% Duncan test level, tn = not significantly different, hst = days after planting.

The results of the analysis of variance showed that there was no significant interaction between nitrogen (N) and potassium (K2O) administration on the number of leaves and leaf area of Jatropha curcas at all ages of observation. but giving a low nitrogen level of 40 kg N/ha with a potassium level of 40 kg K2O/ha (N1K1) resulted in the highest total chlorophyll content of all treatments while the lowest total chlorophyll content result was obtained with a combination of providing a high nitrogen level of 120 kg N/ ha with a potassium level of 160 kg K2O/ha (N3K4).

3.1.1 The Effect of Nitrogen and Potassium on Jatropha Plant Growth

The results showed that the application of various levels of nitrogen fertilizer separately had a significant effect on the growth and formation of the vegetative parts of Jatropha curcas. Increasing the application of nitrogen fertilizers tends to inhibit and reduce the growth of Jatropha curcas. This shows that the application of nitrogen fertilizer of 40 kg N/ha is sufficient for the needs of nutrients

in the soil (polybags), although the optimum dose for jatropha if it is assumed to be 80 kg N/ha and the results of soil analysis show that the total N content of the soil is low. ie 0.13%.

The low level of leaching of nutrients in polybag soil even though it rains is the cause of the abundance of nutrients in the soil, so that the application of N fertilizer that is not balanced (excess) causes a decrease in soil pH and phosphorus availability for plants while the provision of various levels of potassium separately has a significant effect on growth and formation of the vegetative part of Jatropha curcas.

From the analysis of variance, it was shown that the increase in potassium actually inhibited and significantly decreased plant growth in the vegetative organs of the Jatropha curcas plant. The best results for all observation parameters were obtained by giving potassium 0 kg K2O/ha or without giving potassium fertilizer.

Table 3. Average Total K Content in Leaves Due to N and K Interaction Age 90 DAP

Treatment	Dosage of Potassium (kg K2O/ha)				
	0	40	80	120	160
40 kgs	1.88ab3	2.08abcd	1.80a	1.13bcd	2.04abcd
80N/ha	1.96abc	2.01abcd	2.10abcd	2.54e	2.32de
120kgN/ha	1.99abc	1.96abc	1.92abc	1.89ab	2.23cd
KK	5,225				

Note: the numbers in the column followed by the same letter are not significantly different at the 5% Duncan test level, tn = not significantly different, hst = days after planting.

3.2 Discussion.

Analysis of variance showed that there was an interaction between the effect of nitrogen and potassium levels on the total N content of leaves at 90 dap. At low nitrogen application, an increase in potassium dose did not show a significant effect on the total N content of leaves, this shows the effect of potassium level on nitrate uptake at nitrogen dose.

Analysis of variance showed that there was an interaction between the effects of nitrogen and potassium levels on the total K content of leaves at 90 dap. At low nitrogen application, increasing the dose of potassium did not have a significant effect on the total K content of the leaves. However, giving a dose of potassium of 120 kg K2O/ha actually increased the total K content of leaves when compared to giving potassium a dose of 40 kg K2O/ha. At moderate doses, giving potassium doses of 40 kg K2O/ha and 80 K2O/ha did not have a significant effect on the total K content of leaves when compared to the treatment without potassium.

Giving different levels of potassium separately significantly affect the growth and formation of the vegetative parts of Jatropha curcas. From the analysis of variance, it was shown that the increase in potassium actually inhibited and significantly decreased plant growth in the vegetative organs of the jatropha plant. The best results for all observation parameters were obtained by giving potassium 0 kg K2O/ha or without giving potassium fertilizer.

4. CONCLUSION

The best results for the initial growth of Jatropha curcas planted in polybags were obtained with the application of nitrogen fertilizer of 40 kg N/ha (~22 g/pot) and without the application of potassium fertilizer (0 kg K2O/ha) whether there was an interaction or not AND Fertilizer use Excessive nitrogen and potassium fertilizer without considering the nutrient content in the soil causes poisoning and salt stress (salt damage) and causes stunted and unhealthy growth of jatropha plants and there are plants that are fertilized with high doses of nitrogen and high doses of potassium containing total N leaves and total K. the leaves get tall but the growth rate of the plant.

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Proposed is that it is necessary to carry out further research regarding the application of nitrogen fertilizer doses at a level of 0 kg N/ha to 40 kg N/ha to obtain the optimum fertilizer dose for the initial growth of Jatropha curcas.

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