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## EFFECT OF INTERCROPPING *Jatropha curcas* ON GROWTH AND YIELD OF ARABLE CROPS (Maize and Vegetable)

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### **ABSTRACT**

*This research study was carried out to investigate the effect of *Jatropha curcas* plant on the growth and yield of Arable crops (maize and vegetable) at Forestry Research Institute of Nigeria (FRIN) Arboretum, Jericho, Ibadan. This research study involves six (6) experimental plots of *Jatropha curcas* interplanted with vegetable and maize in both Mono and Agro-forestry plot respectively. Relative comparison in *Jatropha curcas* plant agronomic parameter such as plant height, stem girth and number of leaves, planted in Mono and Agro-forestry plots were determined and analysed using factorial experimental design in Randomised Completely Block Design (RCBD). The result of analysis of variance conducted shows significant difference in the major treatments and weeks on the parameter assessed while non existence of significant difference was recorded in the combination factor of treatment and weeks. The mean results of the parameters for plant height, stem girth, number of leaves were assessed 4.560g, 4.515g, 3.725g for maize and 127g, 96g, 72g for vegetable plant. Based on the agronomic result obtained in this study can therefore be concluded that *Jatropha curcas* plant could be successfully incorporated in both mono and agro-forestry practices to yield positive effect.*

**Keywords:** *Jatropha curcas*, vegetable, maize, height, stem girth, agronomic

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### **Introduction**

*Jatropha* is commonly known as physic or purging nut, is a non-edible oil-yielding perennial shrub that has green leaves with a length and width of 6 centimeters (cm) to 15cm; it reaches height of 5metres. This plant originated from tropical America and West Asia which later spread to other part of the Continent. The word *Jatropha* was derived from Greek words: *jatros* (doctor) and *trophe* (nutrition). It belongs to the family Euphorbiaceae. The rapid growth in world population coupled with vast rate of development has led to the destruction of many economical/useful plant species. Most of this plant species are badly threatened, while many are

heading for extinction unless serious actions are taken to conserve and protect them, they will be lost eventually.

*Jatropha* is one of these economical plant species that are being driven to extinction, through meaningful research into the plant in relation to importance of *Jatropha* when planted with other crops is essential. *Jatropha* is used in traditional medicine as pesticide, soap and fuel oil for powering diesel engine motor and cooking. Because of its strong root system, *Jatropha* can grow almost everywhere. It can hold water and survive the driest season. It is thus useful in reforestation, soil rehabilitation and soil erosion

projects. A perceived advantage of *Jatropha curcas* is its ability to grow on marginal land and to reclaim and restore eroded areas (Francis *et al.*, 2000). It has been noted that the seed of *Jatropha curcas* plant contains high level of protein and vitamins which are water soluble vitamin (B1, B6 C and nicotinamide) Omolaiye (1998). Amino acids like Lysine leucine, methionine, valine etc. were also found to be considerable present in the seed (Makker, 1992).

Every parts of *Jatropha curcas* have great potentials in boosting the energy and agricultural sustainability, it also have medicinal values. While maximum utilization of *Jatropha curcas* plants while greatly drawn international awareness, there is need to intensify research in the relationship of *Jatropha curcas* with other plants. Therefore the objective of this study is to investigate the agronomic characteristic of maize and vegetable interplanted with *Jatropha curcas* in mono- and agro plots.

### Materials and methods

This research study was carried out in the FRIN arboretum, Ibadan. An area characterized by two peaks of rainfall typical of tropical West Africa, which occur in the months of June and September/October. The average rainfall recorded for Ibadan within this period is 123.2cm while the average temperature is 80<sup>o</sup>8 (44<sup>o</sup>4c) during the dry season while the temperature was less in the raining season (April to October). The mean humidity of Ibadan is 68% as reported by the Metrological station, Federal College of Forestry (FCF), Ibadan.

### Methods

#### *Seed collection*

The seeds of *Jatropha curcas* were collected from Onigambari area at Longe village, Oyo State, while the maize and vegetable was purchased from Dugbe market. measuring instruments such as veneer caliper and meter tape were obtained from Forest Products Development and Utilization Department (F.P.D.&U)

#### *Planting of the seeds*

Pre-planting operation started with land preparation which involves clearing and ridging to accommodate 6 experimental trials plots, this operation was done on Monday 15<sup>th</sup> June, 2009. Planting operation started after pre-planting operation with planting of *Jatropha curcas* seed on Monday 22<sup>nd</sup> June, 2009 on the six (6) experimental trial plots. Post planting operation such as weeding and beaten up was done timely. The 1<sup>st</sup> agronomic data on *Jatropha curcas* plant to determine stem height, stem girth and leaf count were randomly selected and collected on Tue 21<sup>st</sup> July, 2009. 10 random sampling of *Jatropha curcas* stem were marked with ribbon paper tape for identification on both Mono and Agro-forestry plot. Data were collected at 2 weeks interval for 3 months before the cubs of maize was harvested and measured to determine total no. of maize cubs on 20 stands and weight of maize cub from 20 stands. The following objectives were assessed;

- Comparison in growth of *Jatropha* when plant in mono and agro-forestry site
- Comparison in growth of maize when interplanted with maize.
- Comparison in growth when interplanted under Mono to Agroforestry

These are the methods adopted for growth/yield assessment:

- (a) No. of cubs on each stand
- (b) Total no. of cubs on 20 stand
- (c) Weight of maize cub from 20 stands
  - Random picking & weighing of veg. stand from Mono & Agro-forestry plots
  - Random picking and counting of leave of the vegetable plot from Mono &

Agro-forestry plots

- Random selection & measuring the height of the selected vegetable from Mono to Agro plots.

This experiment was analysis using Factorial Experiment in Randomised Complete Block Design (RCBD).

## RESULT AND DISCUSSION

TABLE 1: The mean values of stem height of *Jatropha curcas* taken weekly

period	Jatropha	Jatropha + vegetable	Jatropha + maize	Jatropha + vegetable + maize
Wk. 1	10.47±1.39	11.62±1.34	10.16±1.35	10.48±2.00
Wk. 2	10.47±1.39	11.47±1.34	10.16±1.35	10.80±1.38
Wk. 3	10.22±1.33	10.74±1.22	9.48±0.92	10.30±1.51
Wk. 4	10.36±1.24	11.28±1.37	9.84±0.99	10.57±1.44
Wk. 5	11.10±1.20	12.10±1.73	10.10±0.99	11.80±2.15
Wk. 6	13.30±1.49	15.50±3.06	10.30±2.06	14.50±2.76

### Mean values represent replicate data

From the Table 1 above, Jatropha + vegetable at Week 6 has the highest means height of 15.50cm followed by Jatropha + vegetable + maize (14.50cm) at week 6 and Jatropha only (13.30 cm) at Week 6 respectively. This means that Jatropha performed better when was planted with vegetable than when planted with maize or when it was solely planted. This is similar to the observation finding of (Nair, 1979) that cultivating trees and agricultural crops in intimate combination with one another has some significant influence on agronomic characteristic of each other. King

(1987) stated that in Europe until the middle ages, it was the general custom to clear-fell degraded forest, burn the slash, cultivate food crops for varying periods on the cleared area and planted or sow trees before, along with, after showing agricultural crops. This “farming system” is no longer popular in Europe (King, 1987). Efforts to design major programmes which allow local communities to benefit directly from forests, paved the way for new forestry concepts such as social forestry in many countries (Nair, 1993). One of the approaches was experimentation in the

general field of intercropping and in particular, it was felt that there was a need for a more scientific approach to intercropping research. It was suggested that greater effort were needed with respect to crop physiology, agronomy, yield stability, biological nitrogen fixation and plant

protection (Nair, 1979).

Since there is significant difference in the stem height of *Jatropha curcas* conducted, follow up test was carried out to determined the level of significance in the mean stem height of *Jatropha* planted with Maize, *Jatropha* only and vegetable.

**TABLE 2: The mean values of leaf count of *Jatropha curcas* taken weekly**

period	<i>Jatropha</i> only	<i>Jatropha</i> + vegetable	<i>Jatropha</i> + maize	<i>Jatropha</i> + vegetable + maize
Wk. 1	11.20±3.93	9.80±4.13	13.70±3.27	13.60±3.10
Wk. 2	19.20±6.36	19.60±8.03	23.00±5.68	27.60±7.18
Wk. 3	19.20±4.93	19.80±6.60	25.70±6.17	34.00±12.02
Wk. 4	20.90±5.34	22.50±7.56	28.00±6.25	36.30±12.94
Wk. 5	27.70±6.93	24.30±8.56	32.20±5.71	37.30±14.58
Wk. 6	34.40±8.51	28.40±7.88	44.10±17.37	40.60±18.89

**Mean values represent replicate data**

From the Table 2 above, it was discovered that the highest leave number was obtained when *Jatropha* was planted with maize at the end of six weeks (44.10) followed by *Jatropha* + vegetable + maize of (40.60) at the same period while *Jatropha* only

has mean leave no of 34.40 at the end of 6 weeks. It was observed that *Jatropha* planted with maize performed better in terms of leave no than any other tested plants.

**TABLE 3: The mean values of *Jatropha curcas* girth taken weekly**

period	<i>Jatropha</i> only	<i>Jatropha</i> + vegetable	<i>Jatropha</i> + maize	<i>Jatropha</i> + vegetable + maize
Wk. 1	0.82±0.10	0.80±0.94	0.75±0.15	0.92±0.11
Wk. 2	1.26±0.15	1.23±0.19	1.24±0.17	1.43±0.13
Wk. 3	1.62±0.29	1.45±0.30	1.63±0.26	1.84±0.26
Wk. 4	1.94±0.28	1.86±0.39	1.91±0.19	2.16±0.21
Wk. 5	2.32±0.33	2.18±0.36	2.36±0.31	2.48±0.34
Wk. 6	2.76±0.47	2.56±0.47	2.85±0.47	2.92±0.44

**Mean values represent replicate data**

Table 3 above shows that the highest girth was obtained within Jatropha + vegetable + maize at the end of 6 weeks followed by Jatropha + maize, Jatropha only and Jatropha + vegetable. The ANOVA conducted shows that there is significant difference in the treatment and weeks at 5 % level of probability. The two factors interaction between the treatment and weeks is not significant.

When Jatropha was planted with maize and vegetable highest yield value of maize was obtained with 4.560g followed by Jatropha + maize with 4.515g and 3.725g for maize only.

This observation shows that Jatropha has significant effect on the yield of maize after 6 weeks. The highest value of yield was obtained in maize when planted with Jatropha than when solely planted. Additionally, the highest value of vegetable was also obtained when Jatropha + maize + vegetable was planted with the value of 127g followed by vegetable only with 96g and least value with Jatropha + vegetable of (72g). The same observation is also recorded, Jatropha as has significant effect on the yield of vegetable when planted on Agro-forestry plot.

**TABLE 4: Result of analysis of variance (ANOVA) conducted on the agronomic parameter of inter-planted *Jatropha curcas* with vegetable and maize**

	Df	Height		Leaf count		Girth	
		SS F	Ms	SS F	Ms	SS	Ms
Treatment	3	143.20	47.73	4584.35	1528.12	2.59	0.86
Weeks	5	18.50*		19.31*		10.75*	
Treatment x Weeks	10	271.33	54.27	13842.08	2768.42	98.26	19.65
		21.03*		34.98*		245.63*	
Error	221	75.99	7.60	1250.95	125.10	0.60	0.06
		2.95 <sup>ns</sup>		1.58 <sup>ns</sup>		0.75 <sup>ns</sup>	
		570.70	2.58	17490.20	79.14	17.98	0.08
<b>Total</b>	<b>239</b>	<b>1061.22</b>		<b>37167.58</b>		<b>119.43</b>	

\*Mean significance and <sup>ns</sup> mean not significantly different at 5% level of probability

Table 4 shows the result of analysis of variance conducted on all the parameters assessed. In all the parameters assessed, both treatment and weeks are significantly different at 5% level of probability, while the two factors interaction between the

treatment and week is not significantly different. This implies that both treatment and weeks exposed on the experimental plots under the same geographical and weather conditions have significant influence on the agronomic parameters

determined. The effect of *Jatropha* with arable crops influenced their agronomic performance after assessed for the period of 6 weeks. This study shows that both *Jatropha* plant and crops interplanted significantly improved in their agronomic performance. The leaves of *Jatropha* was fresh and succulent while the other crops shows better improvement in the yield recorded at the end of the stipulated weeks. This supports the finding of Igboanugo (1990), which showed that when *Triplochiton scleroxylon* seedlings were transferred to more clement environmental conditions, there was an upsurge in their shoot growth and growth of other morphological parameters than were possible in their previous environments. When *Jatropha* was in agro-forestry plot it performed better in terms of leave no than when it was solely planted.

## CONCLUSION

When *Jatropha* was planted with maize and vegetable the highest yield value of maize was obtained at the value of 4.560g followed by *Jatropha* + maize with 4.515g and 3,725g for maize only. Therefore, based on the result obtained *Jatropha* has significant effect on the yield of maize because the highest yield value was obtained when interplanted with *Jatropha* than when it was solely planted. Highest yield value of vegetable was also obtained when *Jatropha* + maize + vegetable were planted altogether with yield value of 127g followed by vegetable only

with yield value of 96g and *Jatropha* + vegetable with yield value of 72g. *Jatropha* as well has significant effect on the yield potential of vegetable when interplanted in Agro-forestry plot.

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