Jatropha curcas L: bio-diesel or land reclamation Program?

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Introduction

In 2003, when *Jatropha curcas* L started its emergence from obscurity to prominence as a biodiesel blend in petroleum diesel, so much hypes surrounded the 'wonder plant'. Sweeping claims have been made such as *"little or no fertilizer is required for Jatropha to grow on any soil type; average seed yield of 3.8 t / ha has been quoted in some publication and, with a oil content of 30-35% (oil yield of 1.2 t / ha) Jatropha was expected to be superior to other oil seed"* [1]. In 2007, Fairless [2] cautioned against a pre-mature push to promote large scale Jatropha cultivation without research support on its basic agronomics.

In spite of this caution, million of hectares of Jatropha plantations sprang up in China, India, Latin America and Sub-Saharan Africa.

We present results of basic agronomics of a four year old Jatropha plantation studying: (1) the effect of N fertilizer rates (with blanket application 2.5 t /ha farm yard manure), (2) a 4 year old spacing trial and (3) a comparison of soil physical quality with a > 10 year old fallow.

Young *Jatropha curcas* plantation at Samaru, northern Nigeria

Results

Agronomic parameters of a 4 year old Jatropha plantation as affected by different nitrogen rates at Samaru, Nigeria (spacing is 1.5m * 1.5m)

Nitrogen rates (kg/ha)	Plant height (cm)	Canopy width (cm)	Seed yield (kg/ha)	Biomass yield (kg/ha)
0	141.1	125.9	693.0	22.96
60	158.0	146.5	698.7	22.55
120	151.9	131.8	173.7	35.29
180	136.2	117.5	309.0	36.52

Effect of spacing on performance of Jatopha curcas L at Samaru, Nigeria

Spacing	Plant height (cm)	Canopy width (cm)	Seed yield (kg/ha)	Biomass yield (kg/ha)	Oil content (%)
1.5m*1.5 m	146.8	130.4	468.6	29.3	37.3
1.5 m*2.0 m	115.2	102.2	63.8	20.8	38.0
1.5m* 1.0 m	118.9	118.2	130.7	50.7	37.3
2.0 m*2.0 m	116.4	115.4	117.2	23.9	36.4

Selected soil physical characteristics of Jatropha with fallow and optimal indicator ranges

Physical Characteristics	*Jatropha curcas*	Fallow	Optimal range
Sand (%)	44	44	-
Silt (%)	36	37	-
Clay (%)	20	19	-
Texture	Loam	Loam	-
Relative Field Capacity	0.73	0.77	0.6-0.7
Plant Available Water ($m^3\ m^{-3}$)	0.07	0.05	≥0.15
Air Capacity ($m^3\ m^{-3}$)	0.103	0.095	≥0.14
Macroporosity ($m^3\ m^{-3}$)	0.079	0.079	≥0.07
Bulk density ($Mg\ m^{-3}$)	1.56	1.63	1.40-1.60
Organic carbon ($g\ Kg^{-1}$)	5.7	8.3	15
Structural stability index (%)	1.8	2.6	>7

Conclusion

1. There is great variability in seed yield of Jatropha. One reason could be that the seeds for planting were picked from the wild.
2. None of the treatment with nitrogen rates gave 1 t/ ha seed yield at four years of plantation age!
3. Nitrogen rates promote biomass yield and 60 kg N/ha resulted in highest performance in terms of plant height, canopy width and seed yield.
4. Large differences in seed yield amongst spacing trial also noticed. Narrow spacing supported higher biomass yield.
5. Bulk density, an index of soil compaction, was much lower in soils under Jatropha than in fallow soils and mean value was within the optimal range for loamy soils.
6. Pore size as evidence by plant available water, air capacity and macroporosity was better in soils of Jatropha than in fallow soils and within the optimal range.
7. Though fallow soils recorded higher values of carbon and structural stability index, but the values were still below the optimal range.

Recommendation

- By the 4th year of Jatropha **plantation** age, oil yield is less than 250 kg/ha. This makes poor economic sense to continue to promote Jatropha biodiesel. The proponents of Jatropha biodiesel may need to *"close shop"* or look for alternative oil borne shrubs or plants to promote.
- However, before the curtain is closed on *Jatropha curcas*, it's ability to reclaim soil properties should be explored. Reports here and India [3] have shown that the plant can be a candidate shrub for the management degraded land.

References

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