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Utility Value of *Moringa oleifera* and Its Biomass Productivity When Cultivated as Shrub Under Different Tree Environments

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ABSTRACT

A combination of shrubland and grass species as animal feed is vital and can not be set-aside, since large areas are unsuited for crops but still can be used, justifiably to support "fodder produce" may be of poor quality. Obviously, there exists no strategy for determining what contributions are desirable from shrubland species when associated with grasses as source of quality biomass. Wasteland utilization be focused on productivity, its establishment and efficient maintenance under existing conditions. An experiment conducted for three years confirms that high biomass, dry matter and crude protein yields can be recovered by the combination of *Moringa oleifera* under varying tree environments thereby confirming that the land x shrub species culturing are inseparable from each other.

INTRODUCTION

Village are bestowed with wasteland, but yet faces acute shortage of basic needs, the dilemma is how to make these areas productive. There are good number of shrub species adapted to these areas as vital component of vegetation cover, having potential of high biomass of economic value.

Evaluation of wasteland areas for their use as forage source is a necessary first step to halt spreading degradation and misuse of land. An integrated approach was resolved by considering soil component, vegetation cover, biomass yield, dry matter production and crude protein yield. The parameters like co-cultivation effect of shrubland species with grasses under tree environment developed cohesive eco-structure. The harvest technology in a multistoried coherent plant system proved productive in a time bound period.

The present paper deals with the experimental trials directed to find out the ways and means to convert wasteland as source of biomass production of a good quality, which confirms that the plant species and wasteland culturing are inseparable from each other.

MATERIALS AND METHODS

One hectare acquired land was cleared and minimum tillage practices were used during planning and planting of the shrub species. The trials revealed that the tree species when converted to browse, sustained shaded condition, contributed high biomass, dry matter and crude protein yields.

The certified seeds of varieties were taken for the experimental trials on the field. The experiment was arranged in RBD with four replications. The experimental trials were conducted for 3 years. Freshly harvested plants were cut at 150cm HBH height, weighed and expressed as biomass kg/u.a.

100 g samples were dried at 98 ± 2°C in an oven, powdered and passed through a fine 2 mm mesh. The percent nitrogen was determined by microKjeldahl method (Byers & Sturrock 1965). The crude protein was calculated as N% × 6. The harvest method for different shrubland species was employed to harness biomass, which revealed that high biomass yields were at the height of 150 cm from ground level under varying tree environment conditions (Kulkarni & Dev 2007).

RESULTS AND DISCUSSION

Biomass: The cultivation of *Moringa oleifera* as shrub for biomass yields under different tree environments is presented in Table 1. The observations revealed that harvest effect on biomass was significant in tree environment of *Moringa oleifera* and *Sesbania grandiflora.* The interaction between species × harvest, significantly increased biomass yield.

The cultivation of *Moringa oleifera* with tree environment of *Sesbania grandiflora* yielded highest biomass in the 1st harvest of the 2nd year followed by 2nd harvest of 3rd year. The biomass yields were invariably high in the 2nd year, an increase in fresh biomass was observed throughout the 2nd year in 4th harvest.

The biomass was higher on mean basis, in the tree environment of *Sesbania grandiflora,* followed by *Moringa oleifera, Sesbania sesban, Gliricidia maculata* and *Leucaena leucocephala.* The lowest biomass of *Moringa oleifera* was recorded when cultivated under the tree environment of *Leucaena leucocephala* in 1st harvest of the 1st year.

As regards the performance of *Moringa oleifera,* the biomass significantly varied when cultivated under different tree environments and at different harvests. The interaction effects were significant. The results confirm that high biomass of *Moringa oleifera* resulted under cultivation in tree environment of *Sesbania grandiflora* and *Moringa oleifera* mainly because of microfoliar nature allowing fine interception of the light.

A significant increase between the harvest and different tree environments was observed in treatments H2 × E3T3 (1181.4 kg), H1 × E1T1 (717.1 kg), and as low as H1 × E2T2 (261.47 kg), H2 × E5T5 (261.38 kg), H1 × E5T5 (259.65 kg). The biomass yields in the second year when compared to third year were significantly high. They were almost double and as high as H3 × E3T3 (1102.9 kg), H6 × E3T3 (814.8 kg) and as low as H4 × E2T2 (602.2 kg), H4 × E1T1 (604.5 kg).

The biomass yields were high in E3T3 environment in the third year a consistently high biomass was observed under *Sesbania grandiflora* environment followed by its cultivation with *Moringa oleifera* tree; the cultivation of *Sesbania grandiflora* as shrub with tree, *Sesbania sesban* ranked third, whereas, its cultivation with *Gliricidia maculata* yielded lowest biomass.

Dry matter: Dry matter yield significantly varied in shrub *Moringa oleifera* when cultivated in different tree environments and in different harvest times of the year (Table 2). Highly significant dry matter yield was noted as 276.3, 234.9 and 209.2 kg/u.a. in 2nd harvest of 1st year, 1st harvest of 2nd year and 2nd harvest of 3rd year respectively. On mean basis, data reveal that the dry matter yield of the shrub was significantly high when cultivated in tree environment of *Sesbania grandiflora* and at par when cultivated in *Leucaena leucocephala* and *Gliricidia maculata.*

The dry matter yields indicated a significant difference between the harvest and the environment of third year. The interaction effects between harvest and environment were significant in the 1st harvest, yields were high under E3T3 while lowest in E5T5 and at par with E4T4, which indicates

Table 1: Performance of *Moringa oleifera* for biomass Yield (kg/u.a.) under different environmental conditions.

Year	E1 T1	E2 T2	E3 T3	E4 T4	E5 T5
1999-2000					
H1	367	261.47	717.1	426.6	259.65
H2	366.07	280.67	1181.4	322.8	261.38
2000-2001					
H3	709.82	686.9	1102.9	825.0	593.68
H4	604.5	602.2	830.8	718.6	634.77
H5	669.22	666.35	668.7	764.2	622.6
H6	649.8	633.47	814.8	753.3	712.9
2001-2002					
H7	691.43	656.62	596.0	575.03	599.42
H8	330.12	357.78	908.2	556.6	422.42
H9	378.32	340.45	689.9	674.1	400.75
H10	365.97	335.82	631.9	559.5	362.92
Mean	513.24	482.17	814.2	616.0	487.05
E SE	10.732	H SE	15.177	E × H SE	33.938
CD	29.701	CD	42.004	CD	93.923

Table 2: Performance of *Moringa oleifera* for dry matter yield (kg/u.a.) under different environmental conditions.

Year	E1 T1	E2 T2	E3 T3	E4 T4	E5 T5
1999-2000					
H1	92.97	65.27	180.9	84.9	62.6
H2	95.05	75.95	276.3	84.3	60.4
2000-2001					
H3	143.48	136.7	234.9	162.0	122.8
H4	133.15	134.53	185.2	158.6	135.4
H5	133.95	133.47	144.5	155.3	126
H6	133.2	130.65	171.6	149.8	145.5
2001-2002					
H7	152.28	145.67	135.3	128.2	134.95
H8	73.07	83.6	209.2	128.1	93.35
H9	83.12	82.05	154.0	147.9	94.45
H10	80.82	81.35	127.9	126.75	87.8
Mean	112.27	106.93	182.0	132.6	106.33
E SE	1.8373	H SE	2.5984	E × H SE	5.8102
CD	5.0849	CD	7.1911	CD	16.080

that under its own tree environment *Moringa oleifera* dry matter yield did not show change. Similar results were noticed in E5T5 in 1st year while in the second year as high as 234.9 kg/u.a. in H3 × E3T3, 185.2 kg in H4 × E3T3 and as low as 126.8 kg in H5 × E5T5 and 122.8 kg in H3 × E5T5.

The dry matter yields varied as 126.0 kg to 234.9 kg during 2nd year, while in the 3rd year, the biomass yield decreased when compared with second year. Highest yield of 209.2 kg was observed in 8th harvest of third year of E3T3, followed by 152.28 kg in H7 × E1T1 indicating that co-cultivation with *Sesbania sesban* tree favoured dry matter yield. On mean basis, the results confirmed that under *Sesbania grandiflora* environment, yield of dry matter was high followed by cultivation under *Moringa oleifera.* It is worthy to note that *Moringa oleifera* cultivation under *Sesbania sesban* tree yielded as high as 112.27 kg dry matter.

Table 3: Performance of *Moringa oleifera* for crude protein yield (kg/u.a.) under different environmental conditions.

Year	E1 T1	E2 T2	E3 T3	E4 T4	E5 T5
1999-2000					
H1	23.05	18.3	64.6	33.1	19.35
H2	23.97	22.6	79.9	26.1	19.37
2000-2001					
H3	36.42	34.62	64.8	52.7	35.4
H4	36.42	33.75	48.3	50.1	37.4
H5	34.22	35.07	39.2	39.0	34.9
H6	34.12	32.62	44.2	39.2	37.62
2001-2002					
H7	37.7	40.55	35.0	40.0	30.32
H8	18.25	21.1	56.1	32.9	23.32
H9	21	20.05	40.1	36.7	25.2
H10	20.7	20.45	35.5	31.5	22.32
Mean	28.58	27.91	50.8	38.1	28.52
E SE	0.6227	H SE	0.88063	E × H SE	1.9691
CD	1.7233	CD	2.4371	CD	5.4496

H - Harvest
E1 T1 - Environment of tree *Sesbania sesban*
E2 T2 - Environment of tree *Leucaena leucocephala*
E3 T3 - Environment of tree *Sesbania grandiflora*
E4 T4 - Environment of tree *Moringa oleifera*
E5 T5 - Environment of tree *Gliricidia maculata*
u.a. - Unit Area (4000 sq. ft./360 m^2)
E SE - Environment Significant Coefficient Index
H SE - Harvest Significant Coefficient Index
E × H SE - Environment × Harvest Significant Coefficient

S_1 - Shrub *Sesbania sesban*
S_2 - Shrub *Leucaena leucocephala*
S_3 - Shrub *Sesbania grandiflora*
S_4 - Shrub *Moringa oleifera*
S_5 - Shrub *Gliricidia maculata*
G_1 - Grass *Panicum maxicum*
G_2 - Grass *Pennisetum typhoidum*
G_3 - Grass *Euchleana maxicana*
Ap - Herb *Amaranthus paniculatus*

Crude protein: The crude protein as an important component (Deshmukh & Joshi 1969, Dev 1968, Siren et al. 1970, Joshi et al. 1974) for nutritional evaluation was found to be significantly affected in *Moringa oleifera* when cultivated in association in different tree environments. The observations presented in Table 3 indicate crude protein yields to be significantly high in the 1st, 2nd and 3rd year of the tree environment of *Sesbania grandiflora*. The plants sustained repeated harvests and maintained crude protein yields till the end of 2nd year. Subsequently, the crude protein yields declined on account of lowering of biomass and dry matter yields.

The performance of shrubland species under different tree environments for crude protein yields presented in Table 3 reveals that yields were significantly affected between harvest and the effect of tree environment. *Moringa oleifera* as shrub, yielded significant crude protein yields as high as 79.9 kg (H2 × E3T3), and lowest as 19.35 kg in H1 × E5T5.

The yields were at par in the 1st and 2nd year harvest of the 1st year under E5T5, whereas in the 2nd year, crude protein yields varied between the harvests of the year and the tree environment being as high as 64.8 kg (H3 × E3T3), 52.57 kg (H3 × E4T4) and lowest as 34.12 kg (H6 × E1T1) and 32.22 kg (H7 × E1T1).

Between the third and forth observations under E1T1, crude protein yields were nonsignificant and at par in 5th and 6th harvest of the 2nd year of E4T4 and E3T3, while in the third year, a marginal but significant increase was observed between the harvest and the tree environments. The crude protein yields were higher in *Moringa oleifera* shrub when co-cultivated with *Sesbania grandiflora* and its own tree environment. The crude protein yields were at par on mean basis in E1T1, E5T5. The results confirm that in *Moringa oleifera* cultivation, browse stepped up biomass, dry matter and crude protein yields under *Sesbania grandiflora.*

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REFERENCES

Byers, M. and Sturrock, J. W. 1965. The yields of leaf protein extracted by large scale processing of various crops. Jour. Sci. Fd. Agri., 16: 341-346.

Deshmukh, M. C. and Joshi,R. N. 1969. Leaf protein from some leguminous plants. Science and Culture, 35: 629.

Dev, D.V. 1968. Protein from green plants. Mah. Med. J., 611-617.

Joshi, R.N., Deshmukh, M.G., Gore, M.B. and Mungikar, M. 1974. The yields of leaf protein from short duration crop. J. Sci. Fd. Agri., 25: 117.

Kulkarni, R. Y. and Dev, D. V. 2007. Effect of harvest height on biomass productivity in different shrubland species. Ecol. Env. and Cons., 13(3): 1-4.

Siren, G., Blomback, B. and Alden, T. 1970. Proteins in forest tree leaves. Royal College of Forestry, Stockholm, Publ. 28.