

Short Communication

Effect of pruning and pollarding on shoot development in bakphul (*Sesbania grandiflora* L.)

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Abstract

An experiment was carried out in a roadside agroforestry system established along farm roadsides of Bangladesh Agricultural University, Mymensingh, to investigate the effects of pruning and pollarding on shoot development in *Sesbania grandiflora* L. Six treatment combinations with the stock plants studied during the period from August to September, 2007. The results revealed that the different pruning and pollarding levels had significant variations on the parameters studied at different days after pruning (DAP). Among the treatments the pollarded shoot tip with lower and upper branch pruning produced the highest number of new branches (572) followed by the treatment of intact shoot tip with lower and upper branch pruning with 454 new branches at 60 DAP. The new branches produced from pruning and pollarding treatments attained its maximum length within a very short time. Maximum branch length (24.66 cm) was observed in the treatments of pollarded shoot tip with lower and upper branch pruned off condition followed by the treatment of intact shoot tip with lower and upper branch pruned off condition which attained 17.67 cm of length at 21 DAP. Again the pollarded shoot tip with lower and upper branch pruning produced 1127 number of leaves followed by the treatment of intact shoot tip with lower and upper branch pruning produced 999 leaves at 60 DAP. The results of this study suggest that the severely pruned plant (both lower and upper branch pruned along with pollarded shoot tip) not only produced huge amount of shoot biomasses but also enhance the development of new shoots within a very short period.

Keywords: *Sesbania grandiflora* L., Agroforestry, Pruning and Pollarding.

Introduction

Sesbania grandiflora L. is a fast growing tropical leguminous tree that has multiple economic uses. The useful characteristics of this species include rapid growth, high biomass production, easily propagation from seed, abundant nodulation and potential as nitrogen fixer. Therefore it has a great potentiality in an agrobased country like Bangladesh. The forest resources of the country are being destroyed at an alarming rate. Hence some alternate approaches like agroforestry system should be followed to meet the land crisis situation. Agroforestry is recognized worldwide as the best productive systems from which the rural poor people can meet their 5 F's demand i.e. food, fuel, fodder, furniture and fund. The increase in fodder and biomass production through the management practices of agroforestry system is such a desirable way that should be largely practiced in this country. Pruning and pollarding are the most common practices which should be used in cropland agroforestry as well as in some special cases of utility land, homestead and well bound agroforestry systems. Pruning of shoots is necessary in all stages of growth in order to have desired trunk and canopy structures of the MPTs. The straight trunk should be allowed to grow until it attains a height of about 2.5m. Unusually long branches and upper axis may also be cut off, if necessary, to attain desired canopy structure. (Hossain, 1994). On the other hand, Pollarding is the use of proper pruning cuts to make tree crowns smaller and to permanently keep them that way. Thus, *Sesbania grandiflora* can be pruned, lopped or pollarded for shoot development, forage production and green manuring purposes. Therefore, the present study was undertaken with a view to determine shoot development especially leaf forage in *Sesbania grandiflora* L.

Materials and Methods

The present experiment was carried out in the experimental plots under a Roadside Agroforestry Project established along farm road sides of Bangladesh Agricultural University, Mymensingh during the period from August to September, 2007. The experimental area is located (AEZ-9) at 24°75'N latitude and 90°50' E longitude at an 18 m above the sea level (UNDP and FAO, 1988). The experiment was conducted in a Randomized Complete Block Design (RCBD) with three replications. There were six treatments and three blocks in the experiment. In this study one and half years old *Sesbania grandiflora* L. plants were used as a plant material. There were two factors of the experiment viz. A. Shoot tip conditions which include- a). shoot tip intact b). shoot tip pollarded and B. Branch pruning levels which include- c). no pruning d). only lower branches pruned off (up to 1.75m height) and e). Lower + upper branches pruned off at 50% length. Hence, the treatments were T₁ = control, T₂ = intact tip with lower branches pruned off up to 1.75m height, T₃ = intact tip with lower + upper branches pruned off at 50% length, T₄ = shoot tip pollarded with no branch pruning, T₅ = shoot tip pollarded with lower branches pruned off, T₆ = pollarded shoot tip with both lower + upper branches pruned off at 50% length. The parameters were the number of new branches, length of new branches and total numbers of leaves in new branches as an indicator of leaf forage production of the pruned plants at different DAP in *Sesbania grandiflora*. All the parameters were studied and data were recorded. The data for each of the parameters were analyzed to find out variations resulting from experimental treatments. The mean results were compared by Least Significant Difference (LSD) Test (Gomez and Gomez, 1984)

Results and Discussion

At day 60 the new branch number was 464 in pollarded shoot tip and 300 in intact shoot tip. Thus the stocks with pollarded shoot tip produced the highest number of new branches (Table 1). Maximum number of branches (513) was observed in severe pruned stocks i.e. lower + upper branch pruned level at 60 DAP and minimum branch number (289) was recorded in no pruning condition at the same DAP (Table 2). Maximum number (572) of branches was observed in treatment of pollarded shoot tip with lower + upper branch pruned off condition at 60 DAP and minimum branch number (179) was recorded in the treatment of intact tip with no branch pruning level at the same DAP. (Table.3)

Table 1. Effect of shoot tip conditions on number of new branches at different DAPs in *Sesbania grandiflora*

Shoot tip condition (A)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
Shoot tip intact	100	154	203	246	263	281	300
Shoot tip pollarded	191	269	306	367	380	416	464
LSD (P≥ 0.05)	16.35	18.43	15.26	20.13	16.75	18.02	14.28

Table 2. Effect of branch pruning levels on number of new branches at different DAPs in *Sesbania grandiflora*

Branch Pruning levels (B)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
No pruning	86	139	161	219	232	259	289
Lower branches pruning	120	177	223	269	285	313	344
Lower + Upper branches pruning	230	319	381	433	449	473	513
LSD (P≥ 0.05)	17.44	16.75	19.66	14.33	13.49	21.21	11.22

Table 3. Interaction effect of shoot tip condition and branch pruning level on number of new branches at different DAP in *Sesbania grandiflora*

Treatment combination (A x B)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
T ₁	29	69	105	142	155	166	179
T ₂	73	106	161	200	220	245	267
T ₃	198	287	344	396	415	432	454
T ₄	142	209	216	295	309	351	398
T ₅	168	247	286	337	350	382	422
T ₆	262	350	418	469	483	514	572
LSD (P \geq 0.05)	24.67	23.69	27.80	20.27	19.08	29.99	15.86
CV %	9.32	6.15	6.00	3.63	3.26	4.73	2.28

The length of branches was observed to be very slow increase (4.311cm) in intact tip and more or less similar (6.711cm) in pollarded tip at 7 DAP. However, it slowly increased by 14 DAP, followed by more or less rapid increase subsequently. The maximum length was 64.00 cm in pollarded shoot tip and 44.88 cm in intact shoot tip at 60 DAP (Table 4). The highest length (72.33cm) were observed in more pruned level i.e. both lower + upper branches pruned off at 50% of branch length and the lowest length (42.50cm) was recorded in no pruning condition which were statistically similar to lower branch pruned off level which results (48.500cm) length at 60 DAP (Table 5). The highest length (24.66cm) was observed in treatment of pollarded shoot tip with lower + upper branch pruned off condition at 21 DAP while the lowest length (11.33cm) was found in the treatment of control with intact tip + no branch pruning condition. (Table 6)

Table 4. Effect of shoot tip conditions on length (cm) of new branches at different DAPs in *Sesbania grandiflora*

Shoot tip condition (A)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
Shoot tip intact	4.31	7.55	14.11	20.78	28.11	40.33	44.88
Shoot tip pollarded	6.71	10.50	18.55	27.71	36.33	54.22	64
LSD (P \geq 0.05)	0.76	0.54	1.50	1.86	2.11	2.04	5.06

Table 5. Effect of branch pruning levels on length (cm) of new branches at different DAPs in *Sesbania grandiflora*

Branch Pruning levels (B)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
No pruning	4.40	7.32	13.33	19.50	27.33	37.67	42.50
Lower branches pruning	4.81	8.02	14.33	22.17	29.83	43.50	48.50
Lower + Upper branches pruning	7.32	11.75	21.17	31.07	39.50	60.67	72.33
LSD (P \geq 0.05)	0.59	0.58	1.32	2.18	2.65	2.09	6.90

Leaf number was observed to be very low (166) in intact tip and (353) in pollarded tip at 7 DAP. The maximum leaf number was 976 in pollarded shoot tip and 634 in intact shoot tip at 60 DAP. (Table 7) The highest leaf number (1063) was observed in severe pruning level i.e. both lower + upper branches pruned off at 50% of branch length and the lowest leaf number (652) was recorded in no pruning level at 60 DAP (Table 8). The highest leaf number (1127) was observed in treatment of pollarded shoot tip with lower + upper branch pruning level at 60 DAP and the lowest (447) was recorded in treatment of control which was similar (454) to treatment of intact tip + lower branch pruned off condition at same DAP. (Table 9)

Table 6. Interaction effect of shoot tip condition and branch pruning levels on the length (cm) of new branches at different DAP in *Sesbania grandiflora*

Treatment combination (A x B)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
T ₁	2.90	6.06	11.33	15.66	22.33	30.33	32.00
T ₂	3.40	6.76	13.00	19.66	25.33	35.66	39.33
T ₃	6.63	9.83	17.66	27.00	36.66	55.00	63.33
T ₄	5.90	8.56	15.33	23.33	32.33	45.00	53.00
T ₅	6.23	9.26	15.66	24.66	34.33	51.33	57.66
T ₆	8.00	13.66	24.66	35.13	42.33	66.33	81.33
LSD (P \geq 0.05)	0.84	0.83	1.87	NS	NS	NS	NS
CV %	8.46	5.06	6.31	7.00	6.04	3.45	9.86

Table 7. Effect of shoot tip condition on the number of leaves in new branches at different DAPs in *Sesbania grandiflora*

Shoot tip condition (A)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
Shoot tip intact	166	227	363	440	489	525	634
Shoot tip pollarded	353	472	607	721	765	820	976
LSD (P \geq 0.05)	24.54	22.69	24.82	27.04	22.03	31.06	37.80

Table 8. Effect of branch pruning levels on number of leaves in new branches at different DAPs in *Sesbania grandiflora*

Branch Pruning levels (B)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
No pruning	179	225	370	469	527	563	652
Lower branches pruning	205	266	438	508	545	582	699
Lower + Upper branches pruning	394	559	647	766	810	873	1063
LSD (P \geq 0.05)	25.55	30.63	20.83	26.99	21.24	38.29	46.14

Table 9. Interaction effect of shoot tip condition and branch pruning levels on the number of leaves in new branches at different DAP in *Sesbania grandiflora*

Treatment combination (A x B)	Days after pruning/pollarding (DAP)						
	7 DAP	14 DAP	21 DAP	28 DAP	35 DAP	42 DAP	60 DAP
T ₁	66	94	188	255	340	386	447
T ₂	91	137	306	330	348	371	454
T ₃	341	451	595	733	779	819	999
T ₄	292	355	553	678	713	740	857
T ₅	318	395	569	686	741	793	943
T ₆	447	667	699	799	841	926	1127
LSD (P \geq 0.05)	36.14	NS	29.46	38.17	30.04	54.16	65.25
CV %	7.66	6.81	3.34	3.62	2.63	4.42	4.46

The results presented in this study are in good conformity with other researchers. In this study it was observed that severe pruning/pollarding condition i.e. pollarded shoot tip with lower and upper branch pruning levels always produced higher number of buds, branches and leaves followed by the treatment of intact tip with lower and upper branch pruning level.

According to Bisla *et al.* (1990) hard pruning results significant effect on higher number of secondary and tertiary shoots and the largest leaf area. The results of the present study are similar to the findings of Bisht *et al.* (1998) who observed that pollarding *G. optiva* at 2 m height but leaving the main shoot intact to produce maximum fuel and fodder. Tipu *et al.* (2006) observed that the stocks with higher pruning height (150 cm) always produced higher number of branches as well as leaves than those with lower pruning heights (100 cm). According to Hossain (2007) the pruning of branches and pollarding of upper levels of Neem, Jatropha and Bakphul markedly enhanced shoot regeneration resulting the plants into stout, good looking and uniform in appearance, as well as, higher production of shoot biomass compared to control plants. After pruning and pollarding the rapid growth and development of young shoots also indicate that this practice will be commercially helpful to the farmers of Bangladesh for forage, fuel and green manure production.

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