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Species Trial For Fuelwood Production (Part-2)

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ထင်းမီးသွေးအတွက်သစ်မျိုးစုံစမ်းသပ်စိုက်ပျိုးခြင်း

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Abstract

Fast growing fuelled species has been planted extensively every year so as to meet the heavy demand for fuelwood in the country. In order to get the maximum benefit from these plantations, it is necessary to know which species and what spacing can give the highest fuelwood yield. Consequently, in 1983, a research plot was established in Compartment (31), Hmawbi Researved Forest, Hmawbi Township. Species tested and compared were bawzagaing K 28, bawzagaing K 62, bawzagaing K 132, sit, bomeza, myama-subyu, mezali and mahogany. To each species, 3' x 5', 5' x 5', 7' x 7' and 9' x 9' spacings were applied. Assessments in 1987 showed that bawzagaing K 62, bawzagaing K 132, bawzagaing K 28, sit and mezali are suitable for planting in Hmawbi area. Out of the four spacing tested, 3' x 5' and 5' x 5' gave the highest fuelwood yield.

Contents

1. Introduction

Nowadays, almost every country in the world is faced with the problem of shortage of fuel (Schenck, 1980). Due to the increased in population and the dwindling supply of fossil fuel followed by a sharp rise in the price of such fuel, approximately one third of the world population is now depending upon fuelled and charcoal as fuel (Ayensu, 1980). In the developing countries, 86% of the timber produced are being used as fuel and half of this amount is consumed for cooking (Ayensu, 1980). Use of wood as fuel in the developed and developing countries was estimated to be in the ratio of 1: 9. (Arnold, 1978)

Such great demand on wood for fuel has resulted in an accelerated destruction of forests all over the world, and it was estimated that 49.42 million acres of forests are being destroyed annually. (Anon, 1987)

Burma, which is one of the developing countries in the world also depends heavily on wood for fuel . Before the shortage of fossil fuel arises in the country, a high proportion of the urban and some rural populations used the IDC kerosene stove for cooking. However, due to the scarcity of kerosene, a very high proportion of both the urban and rural population are now using either fuelled or charcoal as fuel.

Although 57% of the area of Burma is covered with valuable forests, some regions are now facing the problem of scarcity of fuelwood (Ko Ko Gyi & Aung Khin, 1984). This is also due to the increased in population and demand on wood for fuel construction purposes. Wood, especially fuelwood problem arises in regions where the population is concentrated (e.g. Rangoon, Mandalay, etc.) or regions where the climatic condition is too dry to support good growth of forests. (e.g. the central dry zone of Burma and it's fringes).

In 1984, the total population of Burma was 35.06 millions and the average per capita forest area was 2.73 acres. (Ko Ko Gyi & Aung Khin, 1984). At present (1987) the population has increased to approximately 38.0 millions. (Chin & Moreau, 1987). Consequently the average forest area per capita also dropped to 2.52 acres; ie. a drop of 0.21 acres of forest area per capita within 3 years. In the fuelwood deficit regions of the country, the per capita forest area could be far less than 2.52 acres.

The decrease in the fossil fuel resources and the steady increase in population will eventually lead to the steady increase in the demand of fuelwood and scarcity of wood. In order to meet this increasing demand on fuelwood, it becomes necessary to establish vast areas of fuelled plantations especially at the fuelwood deficit regions (Schenck, 1980; Wood et. al. 1980; Anon 1980, 1983; pandey 1983; Ko Ko Gyi & Aung Khin, 1984).

The problem within the country was identified and necessary action was taken by the Forest Department by increasing its fuelwood planting program steadily from 8,626 acres in 1982-83 to 19,688 acres in 1986-87. (Personal communication with Forest Department).

At the same time, the Poasants Asiayone Central Body is also educating and organising the farmers and rural people to develop and protect their village forests. As an incentive, prizes were also given on the FAO day to villages that were able to establish good and successful village wood lot. (Anon, 1987)

In order to establish a successful fuelwood plantation in the shortest possible period of time, it is very important to select the right species for the right site. In selecting the species for fuelwood plantation, it is important to see that -

(a) they are suited to the site.
(b) they have good growth and good coppicing power
(c) they have reasonably good calorific value
(d) preferably they are multipurpose species
(e) preferably they have nitrogen fixing ability
(f) preferably they do not produce much smoke when used, and
(g) preferably they are not browsed by cattle and goats.

It is also very important to know the correct spacing for a particular species. Spacing also plays a very important role in maximizing the yield, especially in fuelwood plantation. (Ko Ko Gyi & Aung Khin, 1984)

Thus, in order to support the fuelwood planting programme near the vacinity of Rangoon, an experimental plot was established in Compartment (31), Hmawbi Reserve, at Hmawbi Township in 1983. Nine species with four spacing were experiment.

2. Materials and Methods

The experiment was carried out in compartment (31), Hmawbi Reserve, Hmawbi Township, Rangoon Division, in 1983. the species used were:

Bawzagaing K28 (*Lacuna leucocephala* (Lam.) de Wit)
Bawzagaing K62 (*Lacuna leucocephlala* (Lam.) de Wit)
Bawzagaing K132 (*Lacuna leucocephala* (Lam.) de Wit)
Sit (*Albizzia procers* Benth.)
Sha (*Acacia catechu* Willd.)
Mezali (*Cassia siamea* Lam.)
Bonmeza (*Albizzia chinensis* (Osbeck) Merr.)
Mahogany (*Swietenia macrophylla* King.)
Subyu (*Acacia arabica* Willd.)

(A)

(B)

(A) Fuelwood soughted out for bundling and stacking. (B) Small size wood being bundled

(C)

(C) Large size wood stacked for measurement.

The area was clear felled and burned. Four spacing of 3' x 5', 5' x 5', 7' x 7' and 9' x 9' were used. The seedlings were planted in the last week of June 1983. Three weedings were carried out in the first year, two in the second year and two in the third year.

In this experiment, completely randomized design with four replicates was adopted. Each plot was one square chain in area. As different spacing were adopted the number of seedlings in each plot varies from a minimum of 49 to a maximum of 240 seedlings.

The area was clear felled and harvested in April 1987. All the stem and branches having (3 in) diameter and above were cut into 6 ft. length and stacking. Stacked volume for each plot (0,1 acre) was measured.

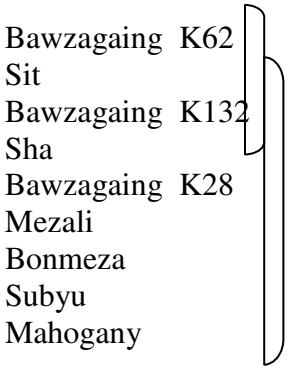
Branches between 1 in. - 3 in. diameter were cut into 18 in. length and bundled into an 18 in. diameter bundle. Bundled volume for each plot (0.1 acre) was measured. Under 1 in. diameter branches were rejected.

The measurements obtained were converted into fuelwood yield per acre. Total volume was computed by adding stacked volume and bundled volume. Statistical F and LSD tests of significance were used in the analysis of data.

3. Results

3.1 Stacked Volume

The results of the differences in the yield of stacked volume were given in Table I, Figure I. The differences in the yield of stacked volume for the species tested were found to be significant. For simplicity, ranking of species is given below with lines linking those species that were not significantly different.



Since ranking of the species tends to form groups that overlap, it can be said generally that Bawzagaing K62 gave the highest yield of stacked volume, sit, Bawzagaing K132, Sha, Bawzagaing K28 and Mezali followed second and Bonmeza, Subyu and Mahogany the poorest.

The differences in yield among different spacing tested were not significant.

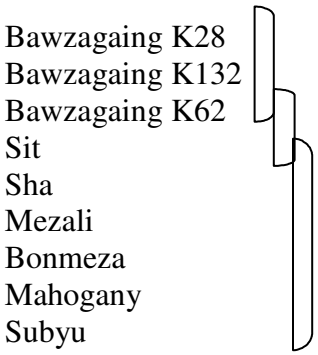
Table I. Stacked Volume Yield per acre.

(Cu. ft.)

Spacing	Species									
	Bawza-gaing (K62)	Bawza-gaing (K28)	Bawza-gaing (K132)	Sit	Bonmeza	Subyu	Mezali	Sha	Maho-gany	Mean
3 x 5	1415.24	771.94	1543.89	1433.62	-	-	508.2	1684.86	-	817.53
5 x 5	3706.38	567.16	518.89	889.53	-	-	630.08	508.08	-	757.80
7 x 7	329.25	307.73	312.79	329.25	-	-	395.11	277.09	-	216.80
9 x 9	350.86	596.47	491.21	329.38	-	-	421.04	310.38	-	277.70
Mean	1450.43	560.83	716.70	745.45	-	-	488.61	695.10	-	

3.2 Bundled Volume

The results of the differences in the yield of bundled volume were given in Table II, Figure I. The differences in the yield of bundled volume for the species tested were found to be highly significant. As in stacked volume, ranking of the species tested were given below with lines linking those species that were not significantly different.



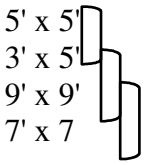
Since ranking of the species tends to form groups that overlap, it can be said generally that Bawzagaing K28, Bawzagaing K132 and Bawzagaing K62 gave the highest yield of bundled volume while the yield of Sit, Sha, Mezali, Bonmeza, Mahogany and Subyu were poor.

Table II. Bundled Volume Yield per acre.

(Cu. ft.)

Spacing	Species									
	Bawza-gaing (K62)	Bawza-gaing (K28)	Bawza-gaing (K132)	Sit	Bonmeza	Subyu	Mezali	Sha	Maho-gany	Mean
3 x 5	347.00	321.64	571.11	124.61	166.34	20.44	103.45	137.39	46.81	204.31
5 x 5	524.82	290.73	590.42	204.04	34.64	10.64	160.36	171.29	100.27	231.92
7 x 7	32.37	215.18	64.75	106.78	17.65	8.19	54.98	44.21	31.31	63.94
9 x 9	189.70	520.92	96.60	38.86	17.53	6.47	58.59	36.55	28.85	110.45
Mean	273.47	337.12	330.72	118.59	59.04	11.44	93.35	93.35	51.81	

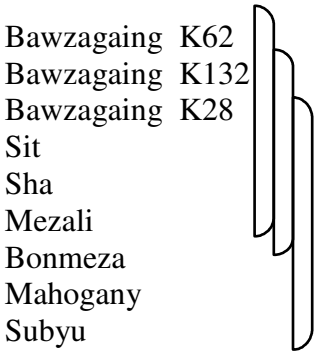
The differences in the yield of bundled volume between the spacings tested were also found to be significant. Ranking of the spacings with lines linking those that were not significant were given below.



Here also ranking tends to form groups that overlap. However, it can be said generally that 5' x 5' and 3' x 5' spacings gave a much higher yield than 9' x 9' and 7' x 7' spacings.

3.3 Total Volume

The results of the differences in the yield of total volume were as given in Table III, Figure I, The differences in the yield of total volume of fuelwood among the species tested were found to be significant. Ranking of yield of total volume of fuelwood by different species is given below with lines linking those that were not significantly different.



Since ranking of the species tends to form groups that overlap, it can be said generally that Bawzagaing K62, yielded the highest total volume of fuelwood. Bawzagaing K132, Bawzagaing K28, Sit, Sha and Mezali followed second while those obtained from the rest were poor.

The differences in the yield of total volume between the spacings tested were also found to be significant. Ranking of the spacing in terms of yield of total volume of fuelwood is given below with lines linking those that were not significantly different.

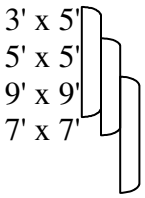


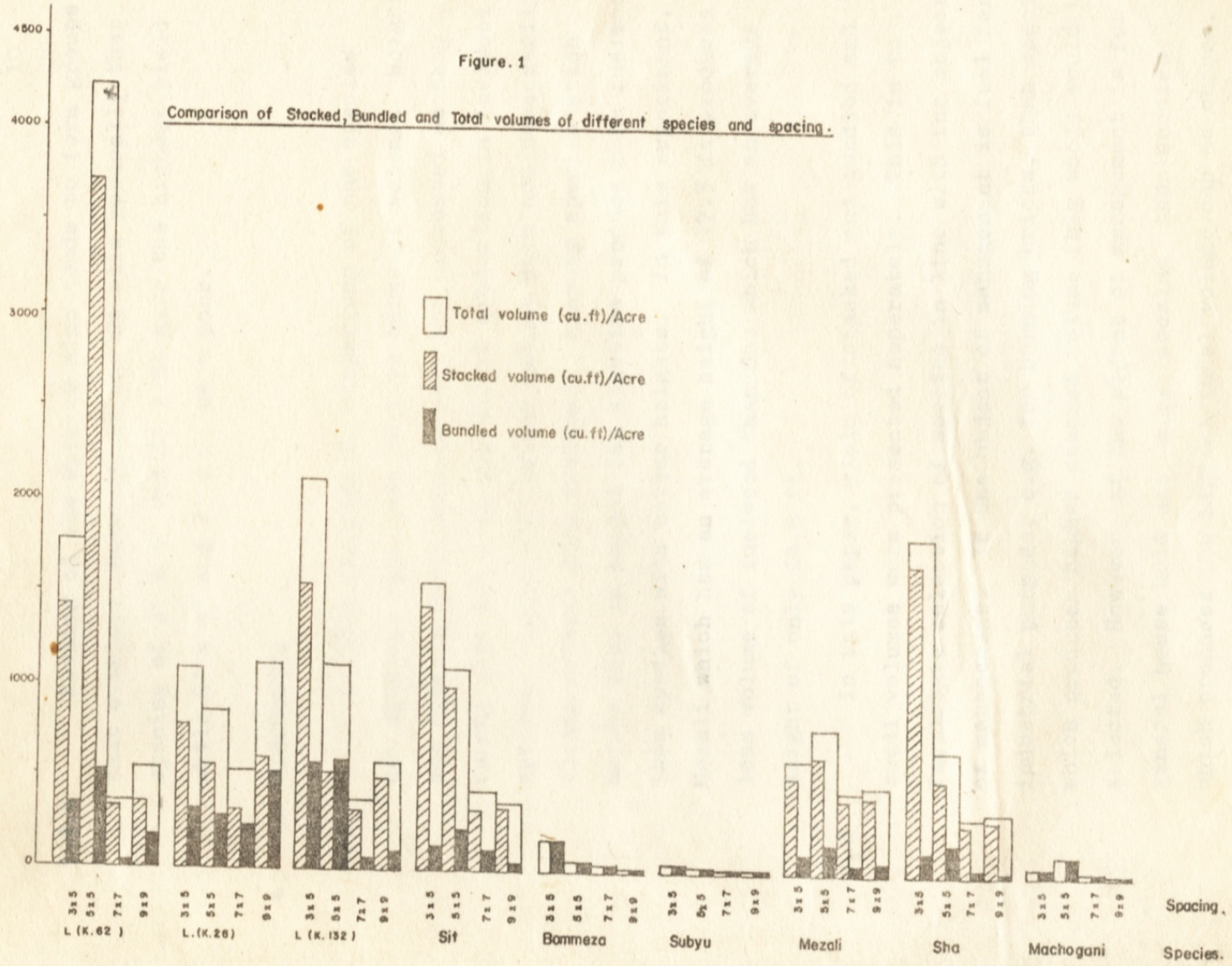
Table III. Total Volume Yield per acre.

(Cu. ft.)

Spacing	Species									
	Bawza-gaing (K62)	Bawza-gaing (K28)	Bawza-gaing (K132)	Sit	Bonmeza	Subyu	Mezali	Sha	Maho-gany	Mean
3 x 5	1762.24	1093.58	2115.00	1558.23	166.34	20.44	611.65	1822.25	46.81	1021.84
5 x 5	4231.20	857.89	1109.31	1093.62	34.64	10.64	790.44	679.37	100.27	989.71
7 x 7	361.62	522.91	377.54	436.03	17.65	8.19	450.09	321.30	31.31	280.74
9 x 9	540.56	1117.39	587.81	368.24	17.53	6.47	479.63	346.93	28.85	388.16
Mean	1723.91	897.94	1047.42	864.03	59.04	11.44	582.95	792.46	51.81	

Figure. 1

Comparison of Stocked, Bundled and Total volumes of different species and spacing.



Ranking of the spacing also tends to form groups that overlap. However, it can be said generally that spacing of 3' x 5' and 5' x 5' gave the highest yield while 9' x 9' and 7' x 7' were poor.

4. Discussion

In this experiment, comparison of the species and spacings were made only in terms of volume. Height and diameter measurements were not presented as they cannot give the true picture of production in fuelwood species. Trees with better height does not necessarily always produce more fuelwood. Branchy species which may be poor in height can sometime produce more fuelwood than species with better highest. In this experiment, Mezali which has an average height of 17.3 ft produces less volume of fuelwood than Sha which has an average height of only 14.8 ft.

In this paper, yield of stacked and bundled and total volumes were presented separately. This is to facilitate selection of species in line with the object of management. If the object of management is fuel for industrial purpose, e.g. for burning bricks, then species which produces higher stacked volume (big wood) would be selected. However, if the object of management is for general house hold use, e.g; cooking, then species which produces the highest total volume can be chosen.

Bawzagaing - All three strains of Bawzagaing tested gave over 90% survival (Ko Ko Gyi, 1986). They have good growth and no disease nor insect attack were observed. Out of the three strains tested, K62 strain produced the highest stacked volume (84%). It was also the best in total volume production. Thus this strain of bawzagaing would be most suited where fuel for industrial use is needed. The species is the best in total volume production.

Sit - Sit gave a rather poor survival (64%) in this experiment (Ko Ko Gyi, 1986). It was heavily attacked by insect and fungus, leaving it leafless during most of the rainy season. Growth and general health of the species were found to be moderate. This species also produced a high stacked volume (86%) as compared with bundled volume.

Sha - Survival of this species was also poor (65%) in this experiment (Ko Ko Gyi, 1986). No fungus nor insect attack were observed. Compared to other species height growth was found to be poor. However, the stem produced a reasonably high ratio of stacked volume (88%). Although the total volume produced by Sha was statistically among the second best group, the production figure along the line in ranking and the field performance is considered to be average. (See Table III, Figure I.)

Mezali - This species gave good survival (88%) in this experiment (Ko Ko Gyi, 1986). No fungus attack was observed. Although slight insect attack was experienced, trees appeared to be healthy. However, height growth was moderate. This species also produced a very high ratio of stacked volume (84%). Total volume production was moderate although it was statistically grouped among the second best.

Bonmeza - Survival was moderately good (74%) in the second year of the experiment (Ko Ko Gyi, 1986). However, only 63% was left at the time of harvesting. It was heavily attacked by insect and both height and general health of the species were poor. It produced only bundled volume as the diameter of the stems was small. Total volume production was also poor.

Mahogany - Survival was slightly poor (63%) and growth was comparatively very slow inspite of the healthy appearance of the species (Ko Ko Gyi, 1986). No insect attack was observed. The species produced only bundled volume as the diameter of the stems was small. Total volume production was also poor.

Subyu - Survival of this species was also poor. Although the surviving trees appeared healthy, both height and diameter growth were comparatively very poor. This species also produced only bundled volume as the diameter of the stems were small. Total volume production was also very poor.

Spacing - From the results obtained, it was clear that the two closer spacings (ie. 3ft x 5ft and 5ft x 5ft) were the best for fuelwood plantation in that area, as they yielded the highest total volume of fuelled. The bundled volume produced by these two close spacings were also comparatively high, indicating that they influence production of more small wood than sizable ones. However, since all the small wood up to the si ze off l in. are useable as fuelwood, this does not affect production in fuelwood.

5. Conclusion

Among the species tested, Bawzagaing K62, Bawzagaing K132 and Bawzagaing K28 are highly recommended as fuelwood species for the site tested.

Sit, Sha and Mezali should be chosen only as a second alternative for this area. Sha, being a dry zone species should be cautiously selected.

Bonmeza, Mahogany and Subyu are definitely not suited for the area tested.

Closer spacing of 3ft x 5ft or 5ft x 5ft should be considered in the establishment of fuelwood plantation in Hmawbi area.

Appendix I

A
Analysis of Variance for Stacked Volume Fuelwood Yield.

Source of Variation	df	Sum of Squares	Mean Square	F
Species	8	7198695.33	899836.92	2.65*
Spacing	3	2661097.86	887032.62	2.61
Error	24	8154570.44	339773.77	
Total	35	18014363.63		

B
Analysis of Variance for Bundled Volume Fuelwood Yield.

Source of Variation	df	Sum of Squares	Mean Square	F
Species	8	507301.42	63412.68	4.73**
Spacing	3	167427.37	55809.12	4.16*
Error	24	321814.98	13408.96	
Total	35	996543.76		

C
Analysis of Variance for Total Volume Fuelwood Yield.

Source of Variation	df	Sum of Squares	Mean Square	F
Species	8	10217905.3	1277238.17	3.06*
Spacing	3	4112678.6	1370892.87	3.29*
Error	24	10012215.4	417175.64	
Total	35	24342799.3		

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