EFFECT OF MYCORRHIZA AND SOIL MOUNDING ON COMMON BAMBOO RAISED FROM CULM CUTTINGS IN RAINFED UPLAND

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ABSTRACT

An investigation was carried out at Orissa University of Agriculture and Technology, Bhubaneswar, India to know the effect of mycorrhiza and soil mounding in newly developed stands of Common bamboo (*Bambusa vulgaris*) raised from rooted culm cultings in rainfed upland. This bamboo is an important cultivated bamboo species of tropical world and is propagated vegetatively like culm cuttings and other methods as it does not produce viable seeds. It comprised of one trial on mycorrhizal inoculation and two different trials on soil mounding carried out on 3rd year and 4th year crop raised from rooted culm cuttings at spacing of 5mx5m. The Vascicular Abruscular Mycorrhiza (VAM) mixed inoculation at different Chlamydospore population were used as the level of treatments to *Bambusa vulgaris* at the time of planting. The plants were studied consecutively for three years. In soil mounding trials, the treatments were : 0" (control), 3", 6", 9" and 12" height mounding from ground level. With increase in the Chlamydosphore inoculum level of VAM fungi there was a progressive increase in the growth and yield parameters for all the three years. However, increase in the growth and yield parameters was at par with the check, thus behaving equally among all treatments. The soil mounding treatments could not yield any significant improvement over control in 3rd year as well as 4th year stand of *B. vulgaris* raised from rooted culm cuttings. This suggests that in rainfed upland situation, soil mounding around clumps is not required. Only the soil around clump should be loosened and washed away soil due to rain be refilled back at ground level.

Keywards: Mycorrhiza, soil mounding, bamboo, *Bambusa vulgaris*

No: of Tables : 3 **No: of References: 7**

Introduction

The Common bamboo (*Bambusa vulgaris* Schrader ex Wendland) is an important cultivated bamboo species of tropical world and is propagated vegetatively like culm cuttings and other methods as it does not produce viable seeds (Koshy and Jee, 2001 and Bhol, 2006). In country like India it is very often planted in rainfed uplands where agriculture is not economic. Soil mounding around bamboo clump is a common practice in village areas of many states in India and other places. This is found beneficial in high moisture areas. Similar works have been reported by Chandrasekhara (1996) and Azmy and Hall (2002). But information is not available on effect of soil mounding in rainfed upland situation that to for Common bamboo raised from rooted culm cuttings. Also the effect of mycorrhiza in new plantations of this species is not known. Hence, an attempt was taken to know the effect of mycorrhiza and soil mounding in stands of *B. vulgaris* raised from rooted culm cuttings in rainfed upland.

Materials and Methods

The studies were conducted at Orissa University of Agriculture and Technology, Bhubaneswar, India. The site is located at 20^0 15' N longitude and $85^0$52' E latitute with an altitude of 25.9 m above MSL. The normal annual rainfall is 1494 mm with 113 rainy days. The investigation was comprised of one trial on mycorrhizal effect and two different trials on soil mounding on 3rd year and 4th year crop of *Bambusa vulgaris* raised from rooted culm cuttings at spacing of 5m x 5m. In mycorrhizal trial, four treatments (3 Mixed innoculum of Vascicular Arbuscular Mycorrhiza having different levels of Chlamydospore population from three different plantations of *Bambusa vulgaris* and control) were imposed. The chlamydospore population and root infection (%) under different treatments were as follows and pictures in Plate 1-3. The Vascicular Arbuscular Mycorrhizal (VAM)

Treatment	Chlamydospore population (No/50 ml of soil)	Root infection (%)
To (Control)	500-525	22-24
T_1	1125-1325	25-27
T_2	1500-1575	31-38
T_3	5000-5375	30-33

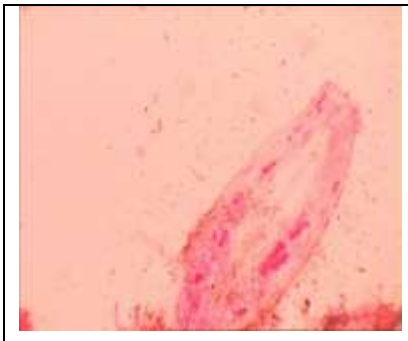

Plate 1. Arbuscule 40X

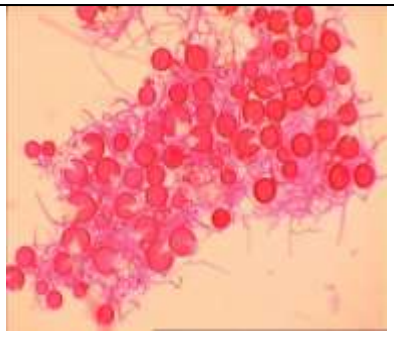

Plate 2. Chlymydo 40X

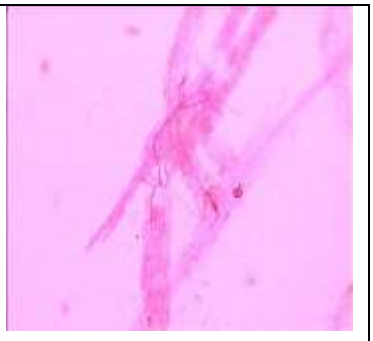

Plate 3. Mycellium 40X

inoculation was done during transplanting of *Bambusa vulgaris* plants in the field. The plants used in transplanting were 4 month old rooted culm cuttings (1-noded) and the pits in which transplanting was done were of the size 45 cm × 30 cm × 30 cm. The mixed inoculums having different Chlamydospore populations and root infection were collected from the clump base of three *Bambusa vulgaris* plantations in the early morning and immediately put in the pits for transplanting. The quantity of innoculum was half the volume of pit and rest half volume of pit was filled with 5 kg FYM and top dug up soil. The innoculum, top soil and FYM were mixed inside the pit. Incase of control only the dug up soil and 5 kg FYM were refilled. The plantation was raised from 4-month old rooted culm cutting at a spacing of 5m x 5m and the experiment was laid out in Randomised Block Design. The performance plants under different treatments was evaluated at the end of 1st, 2nd and 3rd year's growth season

In soil mounding trials, 5 treatments were imposed on 3rd year and 4th year clumps. The treatments were : 0" height mounding from ground level (control - T_0), 3" height mounding from ground level (T_1), 6" height mounding from ground level (T_2), 9" height mounding from ground level (T_3) and 12" height mounding from ground level (T_4). The trials were laid out under Randomized Block Design. The soil mounding of different height at the base of clumps was done in first week of March. The soil around the clumps was loosened and mounded, the top and basal diameter of mounds were about 100 cm and 120 cm, respectively. In control, the soil was loosened around clumps and the washed away soil around clumps due to rains was refilled back at ground level. The performance of plants under different treatments was evaluated at the end of December when year's growth ceased.

Results and Discussion

The results of mycorrhizal effect and soil mounding on the clumps of Common bamboo raised from rooted culm cuttings in rainfed upland are presented in Table 1-3.

Effect of Mycorrhiza

Mycorrhizae association is very common to forest plants. Mycorrhizae are believed to increase water and nutrient absorption capacity of plant root, there by enhancing plant growth and yield. More specifically they increase the absorption capacity of plant roots to phosphorous and minor elements such as calcium and zinc. In the present investigation Vascicular Abruscular Mycorrhiza (VAM) mixed inoculation at different Chlamydospore population were used as the level of treatments to *Bambusa vulgaris* at the time of planting and results have been shown in Table 1. With increase in the Chlamydosphore inoculum level of VAM fungi, there was a progressive increase in the growth and yield parameters such as total number of culms per clump, number of new culms recruited per clump, height of culm, dbh of culm and number of internodes in culm for all the three years. However, the increase in the growth and yield parameters was at par with the check,

thus behaving equally among all treatments.

Table 1. Effect of mycorrhiza on Total number of culm, No. of new culms recruited, Height, DBH and No. of internodes in culm of *B. vulgaris* plantation raised from rooted culm cuttings

Treatments	Total number of culms per clump			No. of new culms recruited per clump			Height of dominating culm (m)		
	1st year	2nd year	3rd year	1st year	2nd year	3rd year	1st year	2nd year	3rd year
T_0 (Control)	1.64	4.94	11.56	1.64	3.30	6.62	2.28	4.34	6.94
T_1	1.68	5.04	11.74	1.68	3.36	6.70	2.32	4.36	6.94
T_2	1.68	5.06	11.80	1.68	3.38	6.74	2.34	4.36	6.96
T_3	1.70	5.10	11.86	1.70	3.40	6.76	2.38	4.38	6.98
SE(m) ±	-	-	-	-	-	-	-	-	-
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Treatments	DBH of dominating culm (cm)			No. of internodes in dominating culm		
	1st year	2nd year	3rd year	1st year	2nd year	3rd year
T_0 (Control)	0.82	2.21	3.68	17.30	24.00	34.65
T_1	0.83	2.21	3.69	17.60	24.12	34.66
T_2	0.84	2.21	3.69	17.76	24.14	34.76
T_3	0.85	2.23	3.70	18.06	24.25	34.86
SE(m) ±	-	-	-	-	-	-
CD (0.05)	NS	NS	NS	NS	NS	NS

The results of the present investigation is in conformity of the work by Jamaluddin *et al.* (1988) who have investigated the effect of VAM on growth and development of *B. bambos*, *Bambusa nutans* and *Dendrocalamus strictus* with negligible growth response which were not significant. Ravikumar *et al.* (1997) and Paroha *et al.* (1999) have reported increased growth in *D. strictus* and *B. arundinacea*, respectively which in contradiction to the present findings. This might be due to differences in the species of bamboo as well as the type of planting materials used. In the present investigation 4 month old *B. vulgaris* rooted culm cuttings were used where as by the above workers 1 month old seedling of *D. strictus* and *B. arundinacea* were used.

Effect of soil mounding

Effect on 3rd year crop

The effect of soil mounding on 3rd year stand of *B. vulgaris* raised from rooted culm cuttings are presented in Table 2. The total number of culms per clump varied remarkably under different treatments. T_1 (3" height from ground level) recorded maximum total number

of culms (10.26/ clump) while T_4 (12" height mounding from ground level) registered the minimum number of culms (9.36). T_1 was statistically at par with T_0 (control). The 3" mounding marginally increased total number of culms, but moundings more than 3" negatively affected the total number of culms.

Regarding number of new culms recruited, the soil mounding at different heights from ground level did not result any beneficial effect. Although T_1 (3" soil mounding) enhanced the new recruitment slightly over control, it was not significantly more. Beyond 3" height, all treatments showed negative impact and the number of new recruitments progressively decreased towards higher mounds. T_3 and T_4 recruited significantly lower number of new culms (5.44 and 5.00, respectively) in comparison to control (5.82).

Table 2. Effect of soil mounding on 3rd year stand of *B. vulgaris* raised from rooted culm cuttings in rainfed upland

Treatments	Total no. of culms/ clump	No. of new culms recruited/ clump	Height of dominating culm (m)	DBH of dominating culm (cm)	No. of internodes in dominating culm
T_0 (Control)	10.18	5.82	6.50	3.45	32.52
T_1 (3" height mounding from ground level)	10.26	5.90	6.44	3.42	32.16
T_2 (6" height mounding from ground level)	10.12	5.76	6.54	3.47	32.65
T_3 (9" height mounding from ground level)	9.80	5.44	6.60	3.50	32.96
T_4 (12" height mounding from ground level	9.36	5.00	6.70	3.56	33.45
SE(m) ±	0.05	0.06	0.05	0.04	0.34
CD $_{(0.05)}$	0.16	0.19	0.17	0.13	1.04

The height growth of dominating culm was influenced by soil mounding. In case of 3" soil mounding there was only slight reduction in height in comparison to control, otherwise in all other treatments the height growth was enhanced. T_4 (12" height mounding) resulted significantly more height than T_0 and T_1. Excepting T_4, all other treatments were statistically at par with each other.

The dbh of dominating culm was also influenced by different levels of soil mounding. All soil mounding treatments excepting T_1 improved dbh of main culm in comparison to control. T_4 was significantly higher over T_1 and rest others were statistically at par with each other.

The number of internodes exhibited similar trend as that of dbh. Maximum number of internodes (33.45) was obtained under T_4 which was at par with control (32.52).

Effect on 4th year crop

The results of the soil mounding effect on 4th year stand of *B.vulgaris* raised from rooted culm cuttings are depicted in Table 3. The data shows that total number of culms per clump was maximum (17.30) under T_1 (3" height from ground level) which was at par with

control (no soil mounding). Above 3" soil mounding all other treatments witnessed reduction in total number of culms and T_4 (12" height soil mounding) recorded significantly lower number of culms (16.44) in comparison to control (17.20).

Table 3. Effect of soil mounding on 4th year stands of *B. vulgaris* raised from ooted culm cuttings in rainfed upland

Treatments	Total no. of culms/ clump	No. of new culms recruited/ clump	Height of dominating culm (m)	DBH of dominating culm (cm)	No. of internodes in dominating culm
T_0 (Control)	17.20	7.00	8.60	4.70	42.00
T_1 (3" height mounding from ground level)	17.30	7.12	8.52	4.64	41.50
T_2 (6" height mounding from ground level)	17.10	6.90	8.66	4.72	42.20
T_3 (9" height mounding from ground level)	16.80	6.60	8.76	4.76	42.68
T_4 (12" height mounding from ground level	16.44	6.24	8.88	4.84	43.26
SE(m) ±	0.15	0.08	0.08	0.05	0.44
CD $_{(0.05)}$	0.047	0.24	0.25	0.16	1.37

The soil mounding had marked bearing on number of new culms recruited. The new culm recruitment was marginally more under T_1 (7.12 culms) than control (7.00 culms), but it was not significantly different. Increase in height of soil mound more than 3" (T_1) negatively affected the new culm recruitment. T_3 (9" height mounding) and T_4 (12" height mounding) recruited significantly less number of new culms than control.

The height of dominating culm was enhanced under T_2, T_3, and T_4 in comparison to control. It was slightly reduced under T_1 (8.52m). T_4 registered significantly more height than T_0 and T_1. Excepting T_4, all other treatments were statistically at par with each other.

The dbh of dominating culm was influenced by soil mounding. Excepting T_1, all other levels of mounding improved the dbh over control, but the values were statistically at par with each other. However, the value of T_4 was considerably higher than T_1. It ranged between 4.64 cm and 4.84 cm among the treatments.

The different levels of soil mounding had bearing on number of internodes. The development of internodes followed the trend similar to dbh. It varied from 41.50 to 43.26.

Results of present investigation revealed significant differences in the total number of culms per clump and number of new culms recruited per clump at different mounding in both 3rd and 4th year crop. Although there was marginal increase in the above two parameters at 3" mounding height, it was at par with control. Beyond 3" mound height there was progressive decrease in above two parameters. On the contrary, significant increase in height of culm, dbh of culm and number of internodes in culm was observed with increase in

mound height. Azmy and Hall (2002) observed significant effect due to mounding after three months at different heights. Similarly Chandrasekhara (1996) has reported soil mounding as a regular practice in village areas of Kerala to stimulate production of new culms. In the present investigation production of culms was significantly less as compare to check. This might be due to soil mounding under low soil moisture condition in the present investigation as compared to soil mounding at high moisture condition as reported by above workers under Malaysia and Kerala situations, respectively. The decrease in culm production as observed in the present investigation is possibly due to hindrances created by physical barrier of soil mounds. However, soil mounding has resulted in increasing size of culms (height, collar diameter, dbh and number of internodes). This may be ascribed to more availability of nutrient and moisture per culm in soil mounding treatments as compared to check because of less number of new culm recruitment.

CONCLUSION

The inoculation of VAM could not exert significant effect on the crop of *B. vulgaris* raised from rooted culm cuttings in the field. The effect of soil mounding around the clumps of different levels (0, 3", 6", 9" and 12" from ground level) in 3rd and 4th year crop resulted significant variation among treatments. However, the results indicated that soil mounding treatments could not yield any significant improvement over control in 3rd year as well as 4th year stand of *B. vulgaris* raised from rooted culm cuttings. This suggests that in rainfed upland situation, soil mounding around clumps is not required. Only the soil around clump should be loosened and the washed away soil due to rain be refilled back at ground level.

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