



RESEARCH ARTICLE

Effect of Agronomic Strategies on Growth, Yield and Quality of *Desmanthus* Pre-Release Culture TND 1308

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ABSTRACT

Field experiments were conducted during 2016-17 and 2017-18 at the Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore to optimize the seed rate and nutrient levels for *Desmanthus* pre-release culture TND 1308. The experiment was laid out in Factorial Randomized Block Design with two replications. The treatments consisted of two seed rates viz., 15 kg/ha and 20 kg/ha as well as nine nutrient management options viz., 75 % of recommended dose of fertilizer as basal, 100 % of RDF as basal, 125 % of RDF as basal, 75 % of RDF as basal + 50 % of N as top dress after each cut, 100 % of RDF as basal + 50 % of N as top dress after each cut, 125 % of RDF as basal + 50 % of N as top dress after each cut, 75 % RDF as basal+75 % of recommended dose of N and K fertilizer every year as top dressing, 100 % RDF as basal + 100 % of recommended dose of N and K fertilizer every year as top dressing, 125 % RDF as basal + 125 % of recommended dose of N and K fertilizer every year as top dressing. Results revealed that adopting the seed rate of 20 kg/ha was found to be optimum for achieving higher growth and yield in *Desmanthus* pre-release culture TND 1308. Besides, the application of 100 % of RDF as basal + 100 % of N and K as top dressing every year was found to be suitable for achieving the maximum growth, yield, and net return in *Desmanthus* pre-release culture TND 1308.

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INTRODUCTION

Agriculture and animal husbandry in India are interwoven with the intricate fabric of the society in cultural, religious and economical ways as mixed farming (Ref). India supports nearly 20 per cent of the world's livestock population and 16.8 per cent of the human population with only 2.3 per cent of the world's geographical area. India is the leader in cattle (16 %) and buffalo (55 %) population and has the world's second-largest goat (20 %) and fourth-largest sheep (5 %) population (Livestock Census, 2012). Hence, the cultivation of nutritious and high yielding fodder is inevitable for enhancing farm animals' productivity and profitability in a sustained manner. Among the cultivated perennial legumes, *Desmanthus* has been acclaimed as a drought-tolerant and proteinaceous forage legume. It can be cultivated throughout the year under irrigated conditions and during monsoon under rainfed conditions. It is an erect, profusely branching, perennial shrub growing to a height of 1.5 to 2 meters. It comes up well in all types of soil and occurs naturally in a wide range of rainfall environments from continually wet to extended

dry seasons. Being a perennial crop, it has a quick regeneration capacity. It does not contain any toxic principles and hence can be safely fed to cattle. It is highly suited for sheep and goat feeding. It can be used as both cut and carry type of fodder or as pasture due to its tolerance to heavy grazing. New *Desmanthus* pre-release culture TND 1308 identified by Department of Forage Crops, TNAU has high dry matter production (33.8%) with the protein content of 23.8% and easily digestible. The first harvest can be done at 90 days after sowing and subsequent harvests can be done once in 40 days. About 6-7 harvests can be done in a year with the green fodder yield of 100-130 t/ha/year. Optimum plant population due to optimal seed rate resulted in higher growth and yield in crops (Karlen *et al.*, 1985). An adequate supply of primary macronutrients enhances the photosynthetic activity and also triggers the metabolic activity in seedlings, which in turn leads to higher growth and yield (Brandon and Date. 1998). Keeping these in view, field experiments were conducted to optimize the seed rate and nutrient management strategy for *Desmanthus* pre-release culture TND 1308.

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MATERIAL AND METHODS

Field experiments were conducted during 2016-17 and 2017-18 at E block of New area farm, Department of Forage Crops, Tamil Nadu Agricultural University, Coimbatore to identify the optimum seed rate and nutrient management strategy for *Desmanthus* pre-release culture TND 1308. The experiment was laid out in a Factorial Randomized Block Design with two replications. The treatments consisted of two seed rates viz., 15 kg/ha and 20 kg/ha as well as nine nutrient management options viz., 75 % of recommended dose of fertilizer as basal, 100 % of RDF as basal, 125 % of RDF as basal, 75 % of RDF as basal + 50 % of N as top dress after each cut, 100 % of RDF as basal + 50 % of N as top dress after each cut, 125 % of RDF as basal + 50 % of N as top dress after each cut, 75 % RDF as basal+75 % of recommended dose of N and K fertilizer every year as top dressing, 100 % RDF as basal + 100 % of recommended dose of N and K fertilizer every year as top dressing, 125 % RDF as basal + 125 % of recommended dose of N and K fertilizer every year as top dressing. The soil of the experimental field was calcareous reddish brown clay loam with organic carbon percentage of 0.62. The EC and pH of the soil were 0.9 dSm⁻¹ and 7.9, respectively.

The soil was low in available nitrogen (181 kg ha⁻¹), medium in available phosphorus (11.7 kg ha⁻¹) and high in available potassium (396 kg ha⁻¹). Fourteen harvests were made during this study period. The growth and yield parameters were recorded for all the cuts. The laboratory analysis for estimating the crude protein percentage was done and data documented. Total nitrogen content was estimated by micro kjeldahl's method suggested by Humphries (1956) and was multiplied by the factor (6.25) to obtain the crude protein content. Crude protein content was multiplied with dry matter yield to obtain crude protein yield. The cost of cultivation and gross returns for all the treatments were worked out on the basis of prevailing input cost and market price of grain at the time of experimentation. Net return was calculated by deducting costs of cultivation from gross return. Data on various characters studied during the course of investigation was statistically analyzed as suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Plant height

Seed rate does not exert any significant influence on plant height of *Desmanthus* pre-release culture TND 1308. However, nutrient management had a significant impact on plant height (Table 1). Among the nutrient management practices, 125 % of RDF as basal + 50 % of N as top dressing after each cut registered the maximum plant height of 135.5 cm

and it was on par with 125 % RDF as basal + 125 % of recommended dose of N and K fertilizer every year as top dressing (128.9 cm), 100 % of RDF as basal + 50 % of N as top dress after each cut (127.4 cm) and 100 % RDF as basal + 100 % of recommended dose of N and K fertilizer every year as top dressing (126.8 cm). Increased availability of nitrogen and phosphorous with above nutrient levels enhanced the cell differentiation and multiplication which might be the reason for higher plant height (Pavithra *et al.*, 2017). Mehta *et al.* (2017) also stated that the higher photosynthetic activity with greater nitrogen supply had led to taller plants. Application of 75 % of RDF as basal recorded significantly lesser plant height of 107.4 cm. This may probably due to the reduced supply of nutrients when compared to above sources.

Green fodder yield

Significant difference in green fodder yield of *Desmanthus* pre-release culture TND 1308 was registered due to different seed rates and nutrient management options (Table 1). Adopting the seed rates of 20 kg/ha recorded significantly higher green fodder yield (133.3 t/ha/yr) when compared to 15 kg/ha (116.5 t/ha/yr). Optimum plant stand establishment due to increased seed rate might be the reason for higher green fodder yield in seed rates of 20 kg/ha. Karlen *et al.* (1985) also endorsed the present findings.

Regarding the nutrient management practices, 125 % of RDF as basal + 50 % of N as top dressing after each cut recorded significantly higher green fodder yield of 140.4 t/ha/yr and it was on par with 125 % RDF as basal + 125 % of recommended dose of N and K fertilizer every year as top dressing (137.6 t/ha/yr), 100 % RDF as basal + 100 % of recommended dose of N and K fertilizer every year as top dressing (135.4 t/ha/yr) and 100 % of RDF as basal + 50 % of N as top dress after each cut (133.2 t/ha/yr). This might be due to proportional supply of primary macro nutrients which in turn allowed the leaves to continue its photosynthetic activity and also triggers the metabolic activity in seedlings led to higher growth and finally yield. The higher green fodder yield with foliar application of nutrients was also reported by Brandon and Date (1998). However, application of 75 % of RDF as basal registered with lowest green fodder yield of 112.2 t/ha/yr. Comparatively reduced supply of nutrients in these treatments might be accumulated relatively less synthates and led to lower green fodder yield. Results of the present experiment also support the earlier observations of Bewley (1997)

Dry matter yield

Dry matter yield of *Desmanthus* pre-release culture TND 1308 was also varied significantly due

to seed rates and nutrient management options (Table 1). Among the seed rates, 20 kg/ha recorded significantly higher dry matter yield (36.2 t/ha/yr) as compared with 15 kg/ha (30.6 t/ha/yr). This was due to higher growth and biomass yield under optimum plant population.

Application of 125 % of RDF as basal + 50 % of N as a top dressing after each cut recorded significantly higher dry matter yield of 36.6 t/ha/yr and it was on par with 125 % RDF as basal + 125 % of the recommended dose of N and K fertilizer every year as a top dressing (35.8 t/ha/yr), 100 % RDF as basal + 100 % of the recommended dose of N and K fertilizer every year

as top dressing (35.7 t/ha/yr) and 100 % of RDF as basal + 50 % of N as top dress after each cut (34.6 t/ha/yr). Adequate availability of nutrients and the presence of larger photosynthesizing surface, production and accumulation of photosynthesis proceeded at a rapid rate leading to greater dry matter accumulation. It might be the reason for significantly higher dry matter yield in these treatments. The results of the present study are also in accordance with findings of Spies *et al.* (1998). However, the application of 75 % of RDF as basal recorded the lowest green fodder yield of 29.6 t/ha/yr. This could be attributed to reduced root and stem growth due to relatively less supply of primary nutrients.

Table 1. Effect of seed rates and nutrient management on growth, yield, quality and economics of Desmanthus TND 1308 (Two years pooled)

Treatments	Plant height (cm)	Green fodder yield (t/ha/yr)	Dry matter yield (t/ha/year)	Crude protein (%)	Crude protein yield (t/ha)	Gross return (Rs/ha/yr)	Net return (Rs/ha/yr)	BCR
Seed rate								
S ₁ - 15 kg/ha	117.9	116.5	30.6	12.0	5.91	265614	173512	2.85
S ₂ - 20 kg/ha	121.9	133.3	36.2	12.3	6.97	302310	208454	3.20
SED	5.0	5.4	1.7	0.52	0.21	Data not analyzed statistically		
CD	NS	11.1	3.4	NS	0.44			
Nutrient management								
N ₁ - 75 % of Recommended dose of fertilizer as basal	107.4	112.2	29.6	11.6	5.69	254201	161036	2.71
N ₂ - 100 % of Recommended dose of fertilizer as basal	119.4	124.3	32.7	12.1	6.48	281225	187369	2.98
N ₃ - 125 % of Recommended dose of fertilizer as basal	123.6	125.5	32.9	12.2	6.62	284318	189771	2.99
N ₄ - 75 % of RDF as basal + 50 % of N as top dress after each cut	111.0	116.8	31.8	11.9	6.03	265765	172486	2.82
N ₅ - 100 % of RDF as basal + 50 % of N as top dress after each cut	127.4	133.2	34.6	12.4	6.85	303123	209115	3.20
N ₆ - 125 % of RDF as basal + 50 % of N as top dress after each cut	135.5	140.4	36.6	12.6	7.09	320876	224671	3.29
N ₇ - 75 % RDF as basal+75 % of recommended dose of N and K fertilizer every year as top dressing	108.4	115.2	30.4	11.7	5.70	263619	170454	2.79
N ₈ - 100 % RDF as basal + 100 % of recommended dose of N and K fertilizer every year as top dressing	126.8	135.4	35.7	12.4	6.82	309324	215458	3.26
N ₉ - 125 % RDF as basal + 125 % of recommended dose of N and K fertilizer every year as top dressing	128.9	137.6	35.8	12.5	6.93	314164	219617	3.28
SED	4.8	5.3	1.5	0.46	0.19	Data not analyzed statistically		
CD at 5%	9.8	10.8	3.4	NS	0.41			

Crude protein content and yield

Results showed that there was no significant variation in crude protein content due to different seed rates and nutrient management options (Table 1). Though crude protein content was not significantly varied with different treatments, crude protein yield showed marked variations. Because crude protein yield is derived by multiplying crude

protein percentage with dry matter yield. Adopting the seed rates of 20 kg/ha registered higher crude protein yield (6.97 t/ha/yr) than the seed rate of 15 kg/ha (5.91 t/ha/yr). More herbage yield with higher accumulation of dry matter due to the optimum plant population increased the crude protein yield. Findings of Rajesh Jolad *et al.* (2018) are in corroborate with the results from the present investigation.

This might be due to accelerated accumulation of dry matter with adequate supply of primary nutrients. However, application of 75 % of RDF as basal registered with lowest crude protein yield due to less dry matter accumulation.

Economics

Different seed rates and nutrient management options had a marked impact on economics of *Desmanthus* pre-release culture TND 1308 (Table 1). Adopting the seed rates of 20 kg/ha recorded maximum gross return (Rs. 3,23,310/ha/yr) and net return (Rs. 2,08,454/ha/yr) with benefit cost ratio of 3.20. However, adopting the seed rates of 15 kg/ha recorded lesser gross return (Rs. 2,65,614 /ha/yr), net return (Rs.1,75,512/ha/yr) and benefit cost ratio (2.80).

Among the nutrient management practices, 125 % of RDF as basal + 50 % of N as top dressing after each cut registered higher gross return of Rs. 3,20,876 /ha/yr and net return of Rs. 2,24,671/ha/yr and benefit cost ratio of 3.29. It was closely followed by 125 % of RDF as basal + 125 % of N and K as top dressing every year and 100 % of RDF as basal + 100 % of N and K as top dressing every year which recorded the comparable gross return (Rs.3,14,164/ha/yr and Rs.3,09,324/ha/yr, respectively), net return (Rs.2,19,617/ha/yr and Rs.2,09,115/ha/yr, respectively) and benefit cost ratio (3.28 and 3.26, respectively). This was due to higher green fodder yield of *Desmanthus* pre-release culture TND 1308 resulted by enhanced supply of nutrients.

CONCLUSION

Adopting the seed rate of 20 kg/ha with application of 100 % of RDF as basal + 100 % of N and K as top dressing every year was found to be optimum for achieving higher growth, yield and net return in *Desmanthus* pre-release culture TND 1308.

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