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Research Article

A high biomass yielding legume fodder variety *Desmanthus* CO 2 suited for all states of India

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Abstract

A high yielding perennial herbaceous legume fodder variety *Desmanthus* CO 2 was developed at the Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. It is a gamma ray mutant of *Desmanthus* CO 1. The mutant was identified owing to its superior performance in station trials conducted from 2013 to 2015. It was evaluated in Multi Location during 2015-17 and in On Farm Trial during 2016-18. Simultaneously it was also tested under the All India Co-ordinated Research Project on Forage Crops and Utilization Trials during 2016-18. The variety CO 2 (mutant TND 1308) registered an overall green fodder yield of 91.04 t/ha in all the trials which were 14.18 per cent increase over the national check CO 1. The mean dry matter yield was 115.1 q/ha which was 15.15 per cent over the national check CO 1. Similarly, it has the mean dry matter yield of 0.55 q/ha/day, the crude protein content of 15.58 per cent, Acid Detergent Fibre of 40.80 per cent, Neutral detergent fibre of 54.38 per cent and *in vitro* dry matter digestibility (IVDMD) of 60.06 per cent ensuring increased palatability, digestibility and intake rate. It ranked first at All India level during 2016 to 2018 for a green fodder yield (44.18 t/ha), dry matter yield (115.1 q/ha) and DMY (0.55 q/ha/day) which was 12.78, 15.15 and 14.58 per cent superior over the national check CO 1, respectively. Considering the green fodder yield and fodder quality of the culture TND 1308, it was proposed and identified for release as *Desmanthus* CO 2 for general cultivation throughout India.

Key words

Desmanthus, Hedge Lucerne, Green Fodder Yield, Legume fodder, Crude Protein

INTRODUCTION

The 20th Livestock Census (2019) has placed the total livestock population at 535.78 million and the total livestock population increase by 4.6 per cent over the previous census. The total population is expected to grow 1.23 per cent in the coming years. The three major sources of fodder supply are crop residues, cultivated fodder and fodder from common property resources like forests, permanent pastures and grazing lands. At the current level of growth in forage resources, there will be an 18.4 per cent deficit in green fodder and a 13.2 per cent deficit in dry fodder in the year 2050. (Vision document 2050, ICAR-IGFRI, Jhansi). Among the forage crops, leguminous crops play a vital role in the reproduction and production

of livestock, especially in milch animals. Hedge Lucerne is one of its kind in which only less work was carried out by the researchers to improve its genetic makeup. So improvement of *Desmanthus virgatus* for higher green fodder yield and quality is still to be intensified. It is imperative to create variability in *Desmanthus* to enhance fodder quality and fodder supply to meet out the demand. *Desmanthus virgatus* is commonly known as *Velimasal* in Tamil and Hedge Lucerne in English. It belongs to the tribe Mimoseae of the subfamily Mimosoideae under the family Leguminosae. It is a perennial shrub that withstands repeated cuttings and regenerates quickly. It is tolerant to drought and suitable for cultivation in all

types of soils and seasons alike. Hedge Lucerne is a native of the tropics and subtropics of the new world. It is found throughout the country. It is highly productive, yielding about 40–70 t/ha of green fodder per year. No poisonous principle is observed in the foliage. Because of its pithy stem, harvesting is easier. It is an ideal plant for wasteland development.

The improvement of a cultivar is usually accomplished by adding one or two desirable attributes to the initial strain and if these desirable characters happened to be introduced by mutagenesis, it is certainly the simplest means to achieve the breeding objectives (Moe and Han, 1973). Gamma rays are used more extensively by many workers on account of their effectiveness (Kale *et al.*, 2000). With this background, a breeding programme was initiated with mutation breeding to improve the existing variety CO 1.

MATERIAL AND METHODS

In order to create variability and to develop high biomass yielding genotypes in *Desmanthus*, a mutation programme was initiated during the year 2010 at New area farm, Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. Hedge Lucerne (*Desmanthus virgatus* (L.) Willd) CO1, an introduction from Thailand was subjected to gamma ray mutation. The seeds were pre-soaked for 12 hours and sun dried. Well filled, handpicked, uniformly sized and dry seeds with a moisture percentage of 10-12 per cent were chosen. A total of 100 seeds were packed in paper covers per treatment and were irradiated with different doses of gamma rays *viz.* 50 to 500 Gys at an interval of 50 Gys at the ⁶⁰Co gamma chamber 1200. The high degree of variability for various yield contributing characters *viz.*, plant height, the number of branches, the number of pods per cluster, the number of seeds per pod and green fodder yield was observed in M₁ generation. Quality analysis was carried out for all the mutants in the M₂ generation.

Superior mutants were selected from M₂ generation in each treatment based on high biomass, green fodder yield and protein content and were forwarded to M₃ generation. Based on the mean performance for green

fodder yield 10 mutants were forwarded to M₄ generation from M₃ generation. Since all the 10 mutants in the M₄ generation have recorded a higher mean for most of the traits over the check, all the 10 mutants were forwarded to the M₅ generation. In M₅ generation, the results on green fodder yield showed that, among 10 mutants, at the dosage of 450-Gy-HB-2 (TND 1308), had recorded the highest green fodder yield (80.12 t/ha/yr) which was a 15.91% increase over than the check CO 1 (69.12 t/ha/yr). It was subjected to evaluation against CO 1 from 2013 to 2015 under station trials. It was promoted for evaluation under Multi Location Trial from 2015 to 2017. Considering its superior performance, it was proposed for conducting OFTs from 2016 to 2018. A total of 96 OFTs – were conducted across Tamil Nadu. Simultaneously, it was nominated for inclusion in AICRP trials and evaluated from 2016 to 2018 in 28 locations of all the five zones across India.

RESULTS AND DISCUSSION

The overall performance of the culture TND 1308 in different trials was presented in **Table 1 and Fig. 1**. It registered an overall green fodder yield of 91.04 t/ha in all the trials which is a 14.18 per cent increase over the national check CO 1. Under the research station trials conducted from *kharif* 2013 to *kharif* 2015, the mutant TND 1308 recorded a mean green fodder yield of 136.90 t/ha which was a 14.13 per cent increase over the check CO 1. The culture was tested in 20 locations under Multi Location trials from 2015 to 2017, in which it recorded a mean fodder yield of 65.13 t/ha with a 15.17 per cent increase over the check CO 1. It was evaluated at 96 locations under the On Farm Trial from 2016 to 2018 which recorded 117.96 t/ha of green fodder yield which is a 14.21 per cent increased yield when compared to the check CO 1. It was evaluated in 28 locations under All India Coordinated Trials from 2016 to 2018. It had recorded 44.18 t/ha of green fodder yield which was a 12.78 per cent yield increase over check CO 1 and ranked first among the genotypes evaluated for green fodder yield (Annual Report, AICRP on FC & U, 2016-18). It has registered a mean seed yield of 170 – 200 kg/ha which is 16.67 per cent higher than the check CO 1 (**Table 1a**).

Table 1. Overall mean performance of TND 1308 for green fodder yield

S. No.	Trials	Number of Trials/ locations	Green fodder yield (t/ha)		% increase over CO 1
			TND 1308	National check CO 1	
1	Research Station Trials (2013-15)	2	136.90	119.95	14.13
2	Multi Location Trials (2015-17)	20	65.13	56.55	15.17
3	On Farm Trials (2016-18)	96	117.96	103.28	14.21
4	AICRP Trials (2016-18)	28	44.18	39.13	12.78
Overall Mean			91.04	79.73	14.18

Table 1a. Mean seed yield of TND 1308 recorded at Station Trials (2016-17)

S. No.	Entries	Seed yield (kg/ha/yr)	% increase over CO 1
1.	TND 1308	175 - 200 kg	16.67
2.	CO 1	150 - 175 kg	-

Fig. 1. Field view of *Desmanthus* TND 1308

With regard to quality aspects, TND 1308 registered its superiority for dry matter yield (DMY) of 115 q/ha and dry matter yield of 0.55 q/ha/day which was 15.15 and 14.58 per cent over the national check CO 1, respectively. It ranked first for dry matter yield (q/ha) and dry matter yield (q/ha/day) among the cultures evaluated under AICRP on FC & U trials. The dry matter portion of the feed indirectly indicates the quality of fodder (John Moran, 2005). The culture has registered the dry matter yield of 14.12 q/ha and crude protein content of 15.58 per cent which is 10.37

and 3.92 per cent superior over the national check CO 1, respectively.

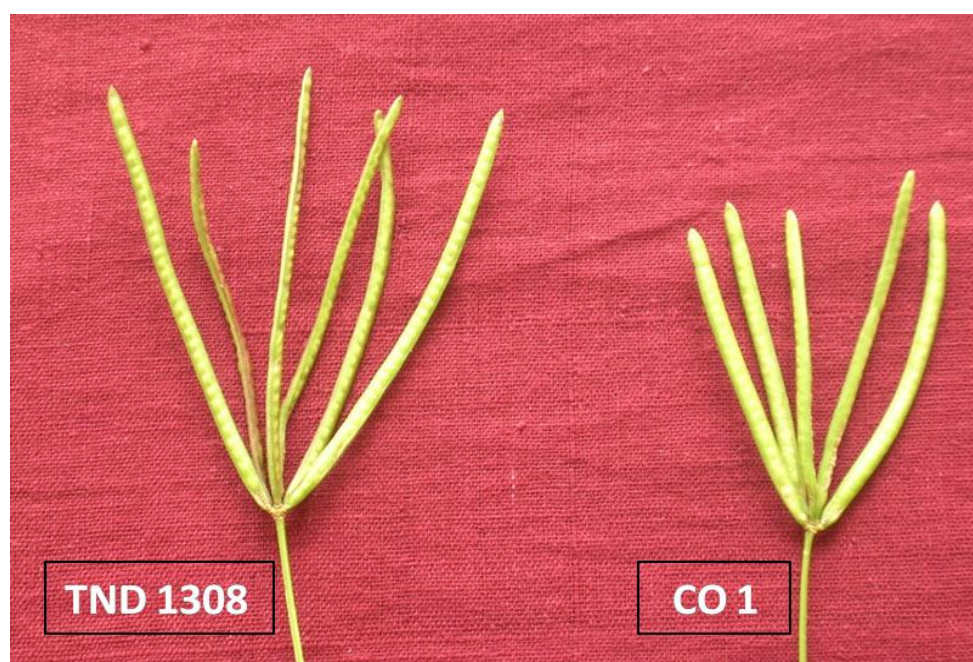
The Acid Detergent Fibre (%) which is the poorly digested and indigestible parts of the fibre (Cellulose and lignin) content was lesser (40.80) than the check (41.95) ensuring higher digestibility which was evident from the result that *In Vitro* Dry Matter Digestibility (%) (IVDMD) was also higher (60.06%) than the check (58.45%) (Table 2). It recorded the Neutral Detergent Fibre of 54.38%.

Table 2. Quality attributes of TND 1308 in AICRP trials over three years (2016 to 2018)

S. No.	Trials	Number of Trials/ locations	TND 1308	National check CO 1	% increase over CO 1
1	Dry matter (q/ha)	28	115.1	100.0	15.15
2	Dry matter yield (q/ha/day)	17	0.55	0.48	14.58
3	Crude protein yield (q/ha)	22	14.12	12.79	10.37
4	Crude protein (%)	22	15.58	15.02	3.92
5	Acid Detergent Fibre (%)	7	40.80	41.95	
6	Neutral Detergent Fibre (%)	7	54.38	54.94	
7	IVDMD (%)	5	60.06	58.45	

Table 3. General botanical description of *Desmanthus* TND 1308

1	Name of the variety	TND 1308
	Common name	Hedge Lucerne/ <i>Desmanthus</i>
	Botanical name	<i>Desmanthus virgatus</i> L.
	Family status	
2	Plant type	In-determinant
3	Foliage	Characterized by light green leaves Shape: Bipinnate leaf Texture: Membraneous Leaflets: Lanceolate leaflets
4	Pigmentation on plant parts	Pink pigmentation in leaf axel
5	Flower colour	White
6	Days to 50% flowering	70-75 days
7	Days to 50% maturity	Does not arise
8	Days to maturity	120-130 days
9	Pod colour	Early stage; Green Maturity stage; Brown
10	Pod length	9-10 cm
11	Number of seeds/ Pods	25-30 seeds
12	1000-seed weight	4.1 gram
13	Seed colour	Dark brown
14	Seed shape and size	Square tending to be round

**Fig. 2. Pod traits of TND 1308 against check CO 1**

It had exhibited superior performance in almost all the locations against the check CO 1 with respect to yield and quality thus proving its wider adaptability. Morphological characters of TND 1308 are furnished in **Table 3 and Fig. 2.**

Considering the green fodder yield and fodder quality of the culture TND 1308, it was proposed and identified for release as *Desmanthus* CO 2 for general cultivation throughout India.

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