



Research Article

A high yielding Lucerne variety CO 2

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(Received: 24 Mar 2014; Accepted: 18 Jul 2014)

Abstract

A high green fodder yielding and nutritious Lucerne culture TNLC 12 was developed at the Department of Forage Crops, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore and released as CO2 during 2013. It is a poly-cross derivative involving CO 1 as one of the parents. It is perfectly inherited with ideal features such as more number of non-lodging stems per crown with dark green and soft leaves and more number of leaf axils per stem leading to high leaf stem ratio. The palatability is very high as the milch animals, sheep, goats, emu and other animals relish the fodder without rejection. It registered a mean green fodder yield of 130.6 tonnes per hectare per year in Research Station and On Farm Trials which was 25.9 per cent increased green fodder yield over the check variety CO 1. It had recorded high crude protein percentage of 23.5 as against 20.5 in CO 1 which resulted in higher crude protein yield of 5.16 t/ha/yr. The dry matter yield and crude fibre content are 21.94 t/ha/yr and 19.2 per cent respectively. Its luxuriant flowering behavior facilitate enhanced seed yield to the tune of 18.2 % more than CO 1.

Key words:

Lucerne, poly-cross, green fodder, crude protein, dry matter, crude fibre.

Introduction:

Lucerne or Alfalfa (*Medicago sativa* L.) is a very palatable and productive herbaceous perennial legume with worldwide distribution. It is having the highest feeding value of all commonly grown fodder crops, producing more protein per unit area and regarded as 'Queen of Forage crops'. It is a native to South West Asia as indicated by occurrence of wild types in the Caucasus and in mountainous region of Afghanistan and Iran. The cultivated forms probably arose in western Persia and then spread to become widely cultivated throughout Asia, Europe and America and widely distributed in temperate regions. The genus contains large number of species. In India other than *M. sativa*, the entire groups of Medicos are treated as wild types. The existing *M. sativa* is largely a tetraploid species ($2n=4x=32$). However, diploids and hexaploids are also found in nature.

Being perennial in nature, it can supply green fodder continuously for 3–4 years from the same crop stand. The root system is deep and so can be easily grown in the areas where water is in short supply. Lucerne has high palatability for all kinds of livestock's as it provides nutritious fodder and possesses about 16–25% crude protein and 20–30% fiber. Due to its high protein and vitamin A content, it is included as a feed component for poultry and piggery. Lucerne provides green fodder for a longer period (November-June) in northern parts and throughout the year in other parts of the country where winter is not severe. In India, Lucerne occupies one million hectare area and provides 60 to 130 tones of green forage/ha. It is grown as a farm crop in Punjab (13,554 acres),

western districts of UP, Maharashtra (18,400 acres), Gujarat (19,900 acres), Tamil Nadu and West Bengal. After sorghum and berseem, lucerne is the 3rd important forage crop in India (Forage Crop Varieties, 2011). In Tamil Nadu, land area utilized for growing fodder is only 1.72 lakh hectares (Season and Crop report, 2009-10) and in which Lucerne is cultivated only in Coimbatore, Tirupur, Erode and Krishnagiri districts. It is not suitable for cultivation in hot and humid areas. Earlier variety, CO 1 was released during 1980 from the Department of Forage Crops.

A high yielding, nutritious green fodder with increased seed yielding habit is the long felt need of the Lucerne farmers of Tamil Nadu so as to bridge the existing wide gap between the demand and supply of green fodder.

With these objectives, crop improvement work was initiated and a new high yielding nutritious CO 2 variety was released to increase the production and productivity of green fodder in Tamil Nadu.

Material and Methods

A National poly-cross nursery programme in Lucerne was started during 2003 at this centre with the objective of creating variability in terms of fodder yield and quality in Lucerne which is a long felt need in legume fodder improvement programme. Coimbatore was the lead centre for this programme and the other participating centres were Anand, Rahuri, Urulikanchan and Mandya. Three popular varieties viz., CO 1, RL 88 and Anand 2 were involved in the poly-cross programme as parents.

As a result of this programme, 25 promising lines have been isolated and the seeds collected were distributed among the participating centres during *rabi* 2008. The lines which have performed consistently better in terms of fodder yield and quality in all the five centres have been identified. Based on the pooled analysis, six elite cultures *viz.*, ACP 1-2, ACP 3-2, CAP 3-2, RRP 5-4, ALP 1-1 and ACP 3-1 have been identified with high yield and quality. The identified cultures have been evaluated further for fodder yield and quality against the checks CO 1, RL 88 and Anand 2 during *rabi* 2009. The culture ACP 1-2 which had performed better at this centre has been isolated and renamed as TNLC 12 for inclusion in the yield trials. It was subjected to continuous evaluation for three years from 2009-10 to 2011-12 for green fodder yield, quality and seed yield. Simultaneously, On Farm Trials have been conducted in the Lucerne growing districts such as Coimbatore, Tirupur, Erode and Krishnagiri during 2010-11 and 2011-12. Based on the standard procedures, the fodder qualities and its acceptability were also analyzed. Besides, the reaction of the farmers upon the performance of TNLC 12, its palatability and its influence on milk yield were also ascertained.

Results and Discussion

The results showed that the culture TNLC 12 had registered exceedingly higher green fodder yield of 130.6 t/ha/yr as against the check CO 1 (103.8 t/ha/yr). The percent increase in green fodder yield over the check CO 1 was 25.9. In the station trials, the culture TNLC 12 accomplished a mean green fodder yield of 134.4 t/ha /yr as compared to check CO 1 (108.2 t/ha /yr) while the results obtained from On Farm Trials showed that TNLC 12 executed a mean green fodder yield of 126.8 t/ha /yr as against 99.4 t/ha /yr in CO 1. The percent increase in green fodder yield over CO 1 was 24.2 and 27.6 respectively (Table 1).

Fodder quality: The culture TNLC 12 is rich in nutrients compared to CO 1 (Table 2). The fodder quality and biomass got conjoined in TNLC 12 uncommonly. It had recorded highest crude protein percentage of 23.5 as against 20.5 in CO 1 which resulted in higher crude protein yield of 5.16 t/ha/yr as compared to CO 1 (3.28 t/ha/yr). Since the dry matter per cent of TNLC 12 is more (16.8) as compared to CO 1 (15.4), the dry matter yield is also higher (21.94 t/ha/yr) as against CO 1 (15.98 t/ha/yr). A relatively reduced fibre content (19.2 %) in TNLC 12 helps to improve the digestibility. The ether extract content, which indicated the readily available nutrients and vitamins to the animals, is also higher in TNLC 12 with 4.9 % as against 4.1 % in CO 1. The contents of P (0.45 %) and Ca (1.89 %) are also appreciably higher. It is also rich in micronutrients such as Fe (420 mg/kg),

Zn (288 mg/kg) and Cu (13.8 mg/kg) as compared to CO 1. The total chlorophyll content of TNLC 12 recorded was 2.02 mg/g as against 1.90 mg/g in CO 1 which offers scope for export. This culture is free from anti-nutritional factors and pests and diseases. As the palatability is very high, the milch animals, sheep, goats, pigs and Emu birds relish the fodder without rejection. For the two traits- Fodder biomass and quality, farmers can always count on Lucerne TNLC 12 to deliver.

Seed yield potential: Seed production in Lucerne is a difficult task as the seeds can be produced only once in a year during summer months. The crop should be harvested during first week of March and allowed for seed production in such a way that the peak period of flowering should concur with summer days. The profuse flowering nature of TNLC 12 helps in getting increased seed yield to the tune of 18.2 % over the check CO 1 (Table 3).

Morphological characters: Distinguishing morphological traits of the culture TNLC 12 are presented in Table 4. It is characterized by significantly more number (15-20) of non-lodging stems per crown with dark green and soft leaves, more number of leaf axils (9-11) per stem against CO 1 (7-9) leading to high leaf stem ratio (0.47) than CO 1 (0.40). The leaflets are lanceolate shaped as against oval to ovate in CO 1. The size and shape of the stipules in TNLC 12 is medium and acuminate as compared to CO 1 which possesses small and long acuminate shaped stipules. The TNLC 12 is characterized by profuse flowering with dense clusters of flower as compared to sparse flowering behavior in CO 1. First fodder harvest can be made at 70-75 days after sowing and subsequent harvests at 20-25 days intervals as against 25-30 days interval in CO 1. Thus, 14 harvests can be made in a year as against 12 harvests in CO 1 due to its superior ratooning ability and early flowering nature.

Special features

- More number of stems per crown with soft and dark green leaves
- High crude protein content (23.5 %) and dry matter yield (21.94 t/ha/yr)
- Profuse flowering nature leads to enhanced seed yield
- Superior ratooning ability and early flowering render 14 harvests per year.
- Highly palatable, preferred by milch cattle, goat, sheep and horses

Reference

Forage Crops Varieties, 2011. Golden Jubilee Publication, IGFRI, Jhansi – 284 003

Season and Crop Report of Tamil Nadu, 2009-10. Department of Economics and Statistics, Chennai – 600 006.



Table 1. Mean green fodder yield of Lucerne TNLC 12

Name of the trial	Year	No. of trials	Green fodder yield (t/ha)		% increase over CO 1
			TNLC 12	CO 1	
Research Station Trials	2009-10 to 2011-12	3	134.4	108.2	24.2
On Farm Trials	2010-11 and 2011-12	81	126.8	99.4	27.6
Over all mean			130.6	103.8	25.9

Table 2. Quality and nutritive values of Lucerne TNLC 12

Characters	TNLC 12	CO 1
Dry matter (%)	16.80	15.40
Dry matter yield (t/ha/yr)	21.94	15.98
Crude protein (%)	23.50	20.50
Crude protein yield (t/ha/yr)	5.16	3.28
Crude fibre (%)*	19.20	20.0
Ether extract (%) **	4.90	4.10
Phosphorus (%)	0.45	0.42
Potassium (%)	3.83	3.90
Sodium (%)	0.22	0.24
Calcium (%)	1.89	1.86
Magnesium (%)	0.37	0.38
Iron (mg/kg)	420	383
Zinc (mg/kg)	288	262
Manganese (mg/kg)	131	127
Copper (mg/kg)	13.80	10.80
Total chlorophyll (mg/g)	2.02	1.90

* Reduced fibre content improves the digestibility

** Indicates readily available nutrients and vitamins to the animals.

Table 3. Seed yield (kg/ha) potential of Lucerne TNLC 12

	2009-10		2010-11		2011-12	
	TNLC 12	CO 1	TNLC 12	CO 1	TNLC 12	CO 1
	285.0	233.0	251.5	220.0	200.0	170.0
Average (kg/ha)					245.5	207.7
% increase over the check variety CO 1					18.2	

Table 4. Morphological and metric traits of Lucerne TNLC 12

Sl. No.	Characters	TNLC 12	CO 1
1.	Leaf colour	Dark green	Green
2.	Leaf shape	Comprise three smooth, slightly toothed, lanceolate shaped leaflets	Comprise three smooth, slightly toothed, oval to ovate shaped leaflets
3.	4 th leaf length (cm)	3.5 - 3.9	3.1 - 3.5
4.	4 th leaf width (cm)	1.3 - 1.5	1.5 - 1.7
5.	No. of leaf axils /stem	9 - 11	7 - 9
6.	Leaf stem ratio	0.47	0.40
7.	Shape of stipules	Medium, acuminate	Small, long acuminate
8.	Plant height (cm)	70 - 80	85 - 90
9.	No. of stems per crown	15 - 20	10 - 15
10.	Stem girth (cm)	1.2 - 1.4	1.0 - 1.2
11.	Days to 50% flowering	65 - 70 days	70 - 75 days
12.	Flower colour	Purple	Dark purple
13.	Length of flower cluster (cm)	2.5 - 3.0	2.0 - 2.5
14.	No. of pods per stem	18 - 20	10 - 15
15.	No. of spirals per pod	3 - 5	2 - 4
16.	No. of seeds per pod	4 - 6	3 - 5
17.	Seed colour	Golden yellow	Golden yellow
18.	Seed size	Medium bold	Medium
19.	1000 seed weight (g)	3.6	3.2

Table 5. Package of practices - Lucerne TNLC 12

Season	:	Throughout the year under irrigated conditions in Coimbatore, Tirupur, Erode and Krishnagiri districts of Tamil Nadu (Not suitable for hot and humid areas)
Soil	:	Well drained black cotton soil is good. Can be raised in alkaline soils also.
Preparatory cultivation	:	Plough 2 to 3 times to obtain a good tilth and form beds and channels of convenient size
Manures and fertilizers	:	Basal FYM - 25 tonnes/ha NPK - 25: 120: 40 kg/ha
Seed rate	:	20 kg/ha
Spacing	:	25 cm apart in lines
Weed management	:	Hand weeding whenever necessary
Plant protection	:	Generally not required for fodder production
Water management	:	Immediately after sowing and life irrigation on 3 rd day. Then once in 10 days depending on soil type and weather condition
Harvest	:	The first harvest 60-65 days after sowing. Subsequent harvests are made at an interval of 20-25 days
Green fodder yield	:	130 t/ha/year (in 14 harvests)

Table 5a. Seed production technologies - Lucerne TNLC 12

Season	:	Seed production once in a year during summer months. The crop should be harvested during first week of March and allowed for seed production in such a way that the peak period of flowering should coincide with summer days.
Manures and fertilizers	:	Top dressing: NPK - 15: 120 : 40 kg/ha.
Plant protection	:	Spraying 0.05% Methyl Dematon or Dimethoate is suggested for the control of Aphids/Ear head bug.
Micronutrient application	:	Spraying of 3% Borax + ZnSO ₄ solution at flower initiation and 50 % flowering stage.
Seed harvest	:	Hand picking of pods at physiological maturity stage
Seed yield	:	245 kg/ha

Plate 1. Morphological features of Lucerne TNLC 12



Luxurious growth of TNLC 12, a sight to behold



More number of leaf axils/stem



Profuse flowering leaves higher seed yield