Table 2. Correlation matrix for diameter class and coppicing behaviour

	Stump diameter	Number of coppices	Basal collar area
Stump diameter	1		
Number of coppices	0.590*	1	
Basal collar area	0.678*	0.687*	1
Basal stump area	0.990*	0.590*	0.685*

*Highly significant ($P < 0.001$).

Basal collar area also showed high positive correlation with basal stump area (0.685). The findings of the present experiment reveal that increasing stump diameter leads to increase in the number of coppices and basal collar area, and the results are in agreement with those of Shackleton[10] for *Terminalia sericea*. The stump diameter has a positive relationship with the number of coppices, and thereby provides high coppice effectiveness.

Coppicing becomes an important and effective tool for reaping intermittent gains of long-term tree improvement and breeding strategies through clonal forestry. The technique is extremely useful in transferring traits with less heritability and ensures transfer of both additive and non-additive gene impacts. It is an essential tool for operational clonal forestry and deployment of promising clones commercially. This study reveals that *M. dubia* is a strong coppicer and can be promoted under clonal forestry to harvest maximum gains under agroforestry by multiplying desired clones.

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Received 10 July 2020; revised accepted 24 November 2020

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Quality enhancement of nutri-cereal browntop millet through agronomic practices

In the recent past, there has been an increasing recognition of the importance of millets as a substitute for major cereals owing to their inherent health benefits apart from climate resilience. Among the small millets, browntop millet (*Brachiaria ramosa* (L.) Stapf., *Panicum ramosum* L., *Urochola ramosa*), is one of the rarest crops commonly known as Dixie signal grass and locally as korale in Kannada and andukorralu in Telugu. It is drought-tolerant, early maturing and harvested in about 75–80 days. This millet is well suited for drylands[1], grown under a variety of soils and climates[2] and can fit into different cropping systems as a catch crop. It grows well in the dryland regions of Tumkur, Chitradurga and Chikkaballapura districts of Karnataka and Ananthapur district of Andhra Pradesh.

Browntop millet is gluten-free, rich in essential nutrients, a good source of zinc, iron, fibre and provides 338 kcal of energy. The mineral composition constitutes 28 mg of calcium, 7.72 mg of iron, 276 mg of phosphorus, 60 mg of potassium, 94.5 mg of magnesium, 1.99 mg of manganese, 7.60 mg of sodium, 2.5 mg of zinc, 1.23 mg of copper and a rich source of natural fibre (8.5%) due to which it serves as an excellent option for dealing with lifestyle diseases[3]. Lower incidence of cardiovascular diseases, duodenal ulcer and hyperglycaemia (diabetes) is reported among those who regularly consume millets. Agronomists have generated a wealth of information on good agricultural practices for millet crops, but meagre information is available with regard to the agronomic practices of browntop millet.

The present field experiment was carried out during *kharif*, 2019 at the College Farm, PJTSAU, Hyderabad. The farm is geographically situated at 17°32′N lat., 78°41′E long. and at an altitude of 541.6 m msl. The experimental soil was sandy loam in texture, moderately neutral in pH (7.1), non-saline in electrical conductivity (EC) (0.31 dS m^{-1}), low in organic carbon (0.47%), and available N (143 kg ha^{-1}), medium in available P (75 kg ha^{-1}) and high in available K (313 kg ha^{-1}). Treatments consisted of four dates of sowing and four levels of nitrogen (Table 1). Grain yield, quality parameters, viz. crude fibre[4], nitrogen[5], protein[6] and zinc content[7] were estimated using standard procedures. Crop (variety VZM-1) was sown according to the treatments at a spacing of 30 cm × 10 cm

Table 1. Yield, quality and economics of browntop millet under varying sowing windows and nitrogen levels

Treatment	Grain yield (kg ha^{-1})	Protein content (%)	Protein yield (kg ha^{-1})	Crude fibre content (%)	Zinc content (ppm)	N content (%)	N uptake (kg ha^{-1})	Net returns	B : C ratio
Factor 1: Date of sowing (D)									
D_1 – 15 June 2019	2003	10.89	218.13	9.50	65.75	1.74	108.35	76,680	2.79
D_2 – 30 June 2019	1837	9.31	171.09	8.28	62.70	1.48	86.54	68,162	2.48
D_3 – 15 July 2019	1738	8.43	146.38	8.06	60.25	1.34	73.06	61,115	2.23
D_4 – 30 July 2019	1540	7.85	120.77	7.73	56.25	1.25	63.38	52,840	1.92
SEm ±	27	0.17	4.59	0.25	0.82	0.013	1.88	2149	0.07
CD (P = 0.05)	77	0.49	13.31	0.73	2.12	0.04	5.43	6207	0.207
Factor 2: Nitrogen levels (N)									
N_1 – 0 kg ha^{-1}	1569	5.81	91.09	7.71	56.50	0.92	45.22	50,861	1.71
N_2 – 20 kg ha^{-1}	1773	8.91	157.91	8.50	59.75	1.42	78.56	60,910	2.04
N_3 – 40 kg ha^{-1}	1855	10.39	192.71	10.70	62.50	1.66	98.77	67,669	2.25
N_4 – 60 kg ha^{-1}	1921	11.37	218.40	7.49	66.00	1.82	112.70	69,701	2.29
SEm ±	27	0.17	4.59	0.25	0.82	0.020	4.88	2149	0.07
CD (P = 0.05)	77	0.49	13.31	0.73	2.12	0.06	14.43	6207	0.207
Interaction ($S \times N$)									
SEm ±	53	0.34	9.16	0.48	1.64	0.033	6.76	4298	0.14
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

with a seed rate of 5 kg ha^{-1}. Nitrogen (urea) was applied according to the treatments in two equal splits of 50% dose as basal (sowing) and the remaining 50% at tillering stage. Entire dose of P as single super phosphate (SSP) (30 kg ha^{-1}) and K as muriate of potash (MOP) (20 kg ha^{-1}) was applied uniformly to all treatments as basal. The experiment was laid out in a randomized block design with factorial concept and replicated thrice.

Grain yield varied significantly among the sowing windows and there was a gradual decrease in yield with a delay in sowing from D_1 – 15 June (2003 kg ha^{-1}) towards the last window D_4 – 30 July (1540 kg ha^{-1}). Deviation in yield was to the tune of 8.28%, 13.23% and 23.11% respectively, over the earliest sowing window D_1 – 15 June. Improved yield associated with the early sowing window might be due to favourable abiotic factors (temperature, soil moisture, day length and reduced pest incidence)[8,9]. Lower yield registered with delayed sowing window might be due to the exposure of crop to dry spells, higher temperature, reduced photosynthetic efficiency and low mobilization of nutrients that coincided with short-day periods reflecting in lower biomass accumulation and yield attributes[10].

With regard to nitrogen levels, there was a gradual and significant increase in grain yield from N_1 – 0 kg ha^{-1} (1569 kg ha^{-1}) to N_4 – 60 kg ha^{-1} (1921 kg ha^{-1}). The grain yields registered with N_4 – 60 kg ha^{-1} and N_3 – 40 kg ha^{-1} were comparable with each other. Higher yield in crop fertilized with 40 kg ha^{-1} nitrogen could be ascribed to improved nitrogen uptake that helped in improved photosynthetic assimilation and translocation towards grain in comparison to the corresponding lower levels of nitrogen application[11,12].

Quality parameters, viz. crude protein (10.89%), protein yield (218.13 kg ha^{-1}), crude fibre content (9.50%) and zinc content (65.75 ppm) in the grain were significantly higher with early sowing window D_1. There was a gradual and significant reduction in quality parameters with delay in the sowing window and the least in D_4 that registered 7.85%, 7.73% and 56.25 ppm of grain protein, crude fibre and zinc content respectively.

Protein content is directly related to nitrogen content. Higher protein content recorded with D_1 could be ascribed to the improved growth coupled with higher N content (1.74%). These findings are in line with those of Chouhan *et al.*[13]. Among nitrogen levels, application of N_4 recorded significantly higher protein content (11.37%), protein yield (218.40 kg ha^{-1}) and zinc content (66.00 ppm). While N_3 registered higher crude fibre content (10.70%) over rest of the treatments. Improved crude protein content and protein yield in D_1 and N_4 were due to higher N content (1.74% and 1.82%) and uptake (108.35 and 112.70 kg ha^{-1}). Nitrogen is a crucial constituent of cell wall besides synthesis of amino acids involved in energy transformations[14,15].

Decrease in crude fibre content with increasing nitrogen level was due to the rapid synthesis of carbohydrates, which were converted into proteins and protoplasm and only a small portion was available for cell-wall material and thus a decrease in pectin, cellulose and hemicellulose contents, which are the major constituents of crude fibre[14]. Improved zinc content with early sowing window D_1 could be ascribed to the favourable weather parameters that reflected in greater assimilation surface and dry matter production coupled with the inherent ability of browntop millet to accumulate zinc from the soil[16]. Higher zinc content in grain in N_4 treatment was due to the low pH in the rhizosphere that resulted due to higher addition of N@60 kg ha^{-1}, congenial for the native soil zinc availability and uptake in comparison to the corresponding lower levels of 40, 20 and 0 kg N ha^{-1} (ref. 17). Net returns and B : C ratio were significantly higher with D_1 (15 June) and N_3 (40 kg ha^{-1}) but comparable with N_4.

In view of the health benefits coupled with its hardy nature, short duration and rich nutrient profile, there is a huge demand for this millet in the recent past. The present study highlights that browntop millet could be a better option in resource-poor dryland regions of Telangana. Further for realizing better yield, quality and monetary returns, the crop should be sown during the ideal sowing window (15 June) and supplied with optimum nitrogen dose (40 kg ha^{-1}).

Conflict of interest. The authors declare that they have no conflict of interest.

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ACKNOWLEDGEMENT. We thank Prof. Jayashankar, Telangana State Agricultural University, Rajendranagar, Hyderabad for support.

Received 23 September 2020; revised accepted 24 November 2020

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Live observation of great blue whale (*Balaenoptera musculus*) from northern Arabian Sea, off Gujarat, India

The great blue whale *Balaenoptera musculus* (Linnaeus, 1758) is the largest animal reported to exist on earth[1,2]. These migratory giants are distributed across major oceans of the world, except the Arctic, Mediterranean, Okhotsk and Bering Seas[3]. In the Indian Ocean, blue whales are only documented from the highly productive northern part[4,5]. The population and distribution pattern of blue whales are poorly understood[5] despite stranding-based information which confirms their presence from Bangladesh, Burma, India and Pakistan waters[6]. Here we report about the sighting of a blue whale from the northern Arabian Sea during the survey between 1 and 15 April 2018 on-board FORV *Sagar Sampada* involving 156 h. The continuous observation using Celestron 7 × 50 Cavalry binocular with GPS and a Nikon D750 camera revealed the presence of the great blue whale off the coast of Gujarat, India. A single individual was sighted 390 km away from Gujarat coast (21°49.91′N, 067°58.29′E) on 3 April 2018, and identified in the field by its very high and broad spout. During the sighting, northerly wind (Beaufort scale 3) and 27°C sea surface temperature were recorded. Photographs were taken to compare them with the published literature[7,8], to reconfirm the species identity. The key morphological characters of the blue whale include twin blowhole with a single ridge, spouting pattern and falcate dorsal fin (Figure 1). No other associated animals were found during the sighting and the gentle giant was cruising at an approximate speed of 4 kn. An average dive time of approximately 5 sec was observed as its diving frequency. With seasonally changing primary producers such as plankton blooms and nutrient-rich deep water close to the shore, the northern Arabian Sea appears to be a cetacean hotspot[9]. Blue whales are known to be present during the monsoon months in the southwest of India, west coast of Sri Lanka and the Maldivian waters[4,5,10]. In Indian waters, blue whale strandings have been reported periodically along Gujarat, Maharashtra and Karnataka coasts and the Lakshadweep Islands[11]. In the absence of exclusive periodic scientific cruises in the Indian waters, Centre for Marine Living Resources and Ecology during 2001–13 had funded a marine mammal programme to Central Marine Fisheries Research Institute to carry out dedicated surveys in the Indian Exclusive Economic Zone and the contiguous seas[8]. In view of the above, it is evident that during the past century, only stranding records of the blue whales are known, but for the observation by the fishermen in 2015 on the Maharashtra coast and the Konkan cetacean research team[12]. Moreover, there are no previous reports of live blue whales available from Gujarat waters. The present sighting suggests