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COMPARATIVE ANALYSIS OF EXOTIC AND NOTIFIED BERSEEM (*TRIFOLIUM ALEXANDRINUM L.*) VARIETIES FOR FODDER, QUALITY AND NUTRIENTS UPTAKE

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SUMMARY

The present investigation was carried out in the Fodder Demonstration Unit of NDDB, Anand (Gujarat) during winter season (*Rabi*) in 2016-17 and 2017-18. The experiment was laid out in a randomized block design (RBD) with three replications consisting of 10 berseem varieties (9 notified and 1 exotic). In pooled analysis of two years data, notified varieties HB-2 and BL-42 statistically at par with each other recorded significantly higher green fodder and dry matter yield of 55.91 t/ha and 10.73 t/ha, respectively over exotic Egyptian variety Miskawi. In berseem varieties mean green fodder, dry matter and crude protein yields ranged between 40.46-55.91, 8.70-10.71 and 1.35-1.82 t/ha, respectively. Significantly lower crude protein content (%) was observed in exotic variety Miskawi (15.92) as compared to notified varieties HB-2 (17.93) and JB-5 (17.65). Dry matter and crude fibre content (%) were recorded higher in BB-2 (21.73) and BL-1 (23.30), respectively. Exotic Miskawi variety recorded highest crude fat content (2.15 %). Higher N and Ca content (%) were recorded in HB-2 (2.87) and JB-5 (1.53) varieties, respectively. Except for Cu, notified berseem varieties were found to have significantly higher macro & micro-nutrients content (N, Ca, Zn, Fe and Mn) in comparison to Miskawi. Mean N, P, K, Ca, Mg and S content (%) among berseem varieties ranged between 2.87-2.53, 0.32-0.34, 1.23-1.63, 1.24-1.53, 0.42-0.47 and 0.24-0.29, respectively. On the basis of pooled data, notified berseem varieties (HB-2, JB-5 and BL-42) were found to be superior over Egyptian variety Miskawi for green fodder & dry matter yields, quality and nutrients content.

Keywords : Berseem, fodder yield, dry matter, varieties, proximate, minerals, nutrient uptake

Berseem (*Trifolium alexandrinum* L.) is one of the most important winter season fodder crop in India known as king of the fodder crop. It is one of the most suitable fodder crops for areas below 1700 m altitude with irrigation facilities. Berseem owes its origin to the Nile valley of Egypt, where it was cultivated since ages as irrigated annual forage crop. (Singh *et al*., 2010) reported that berseem was introduced in India from Egypt in 1904 as rotational crops at government cattle farms and only the 'Miscavi' type characterized by high crown branching with luxuriant growth and multi-cut habit could be widely popularized as high yielding forage legume in entire north and central plains of the country. Since, 1910 its cultivation was taken up by cultivators (Singh *et al.*, 2019). Among the berseem growing countries, India is having highest area around 2 million ha followed by Egypt (1.1 million ha) and Pakistan (0.71 million ha) (Muhammad *et al.*, 2014: Pandey and Roy, 2011). Most of the present cultivars of berseem cultivated in the world are derivative of the ecotype Miskawi (Muscowi USDA), the most common variety grown in Egypt (El-Naby *et al*., 2018). Due to popularity of berseem and shortage of its seed in India, every year large quantity of berseem seed to the tune of 10000 metric tons of 'Miskawi' variety is being imported from Egypt (Dunna *et al.,* 2017) and sold in India. Berseem has become a prominent fodder legume in irrigated areas of the Punjab, Delhi, Haryana, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, West Bengal, Odisha and Chhattisgarh states.

Berseem varieties grown in India are cut multiple times and provides highly palatable, succulent and nutritious green fodder up to 85 to 90 t/ha in 4 to 8 cuttings for longer duration from October to May. Berseem green fodder contains 20% crude protein, 62% total digestible nutrients with 65% digestibility and behaves as a most potent milk multiplier in dairy animals. The additional advantage of berseem cultivation is its ability to substantial improvement in

soil fertility through biological nitrogen fixation. Recent studies show that berseem can be used for phytoremediation of heavy metals viz., Cd, Pb, Cu and Zn due to its multi-cut nature, short life cycle and production of considerable biomass (Ali *et al.*, 2012). Recently scientists have reported solar dryer is an appropriate means for drying of berseem fodder for hay making **(**Singh *et al.*, 2017). Due to these multiple benefits, area under berseem cultivation is increasing in many states of India *viz.* Maharashtra, Rajasthan, M.P. and Gujarat. In Gujarat, dairy farmers of Panchmahal milk union in Panchmahal district have started cultivation of berseem for fodder purpose replacing lucerne. Considering this fact, there is an urgent need to identify suitable variety/varieties of berseem for cultivation in Gujarat, which can provide high quality green fodder for dairy animals. However, due to lack of research on this legume crop in Gujarat, the information's pertaining to relative performance of berseem varieties is not available. Therefore, the present study was planned to evaluate the potential of notified varieties of berseem in comparison to exotic variety Miskawi in terms of fodder yield, quality and nutrients contents under central Gujarat conditions of Anand district.

MATERIALS AND METHODS

The present study was carried out at fodder demonstration unit (FDU) of National Dairy Development Board, Anand (Gujarat) during Rabi 2016-17 and 2017-18. Anand is known as the Milk Capital of India. Anand is located at 22.57°N 72.93°E. It has an average elevation of 39 m. The soil of the experimental site was sandy loam type with EC 0.29, pH 8.09, total nitrogen (764 kg/ha), available P2O5 (84.65 kg/ha) and available K2O (327 kg/ha). The soil contained CaCl2-extractable S (3.73 ppm) and DTPA-extractable Fe (5.2 ppm), Mn (3.66 ppm), Zn (1.91 ppm) & Cu (1.61 ppm). The experiment was laid out in a randomized block design (RBD) with three replications consisting of 10 berseem varieties (9 notified and 1 exotic). In the trial, notified berseem varieties were Wardan (National Check), Bundel Berseem-3 (BB-3), Bundel Berseem-2 (BB-2), Berseem Ludhiana-1 (BL-1), Berseem Ludhiana-10 (BL-10), Berseem Ludhiana-42 (BL-42), Jawahar Berseem-1 (JB-1), Jawahar Berseem-5 (JB-5), Haryana Berseem-2 (HB-2) and Miskawi (Exotic variety from Egypt). For this experimental trial, indigenous developed and notified berseem varieties seed were obtained from ICAR and Agriculture Universities. Seed of exotic variety Miskawi was purchased from market. Crop was sown manually during mid-November during both the years. The total plot size was 20 m^2 (5m × 4m). The crop was fertilized with recommended doses of fertilisers 30:80:60 kg N, P2O5, K2O per ha. Well decomposed farmyard manure (FYM) @ 10 ton/ha and entire quantity of inorganic fetilisers were applied as basal. Seed were treated with Rhizobium trifoli culture obtained from Anand Agriculture University (AAU), Anand. Experimental plots were line sown with treated seeds at the distance of 15 cm with seed rate of 30 kg/ha and immediately irrigated to get proper germination. Hand weeding operations were done at 25-30 days after sowing and one week after each cut to control emerging weeds. Regular irrigations were provided at 15-20 days interval. During the growing seasons in both the years, average monthly weather parameters data are mentioned in Fig. 1 & 2.

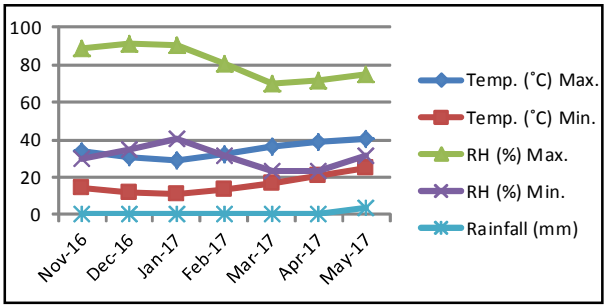

Fig. 1. Monthly weather parameters data recorded at Anand during crop season, *Rabi* 2016-17.

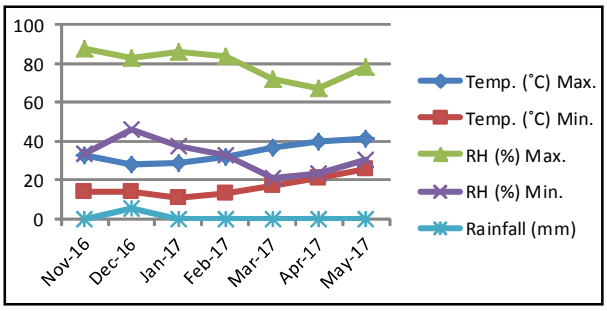

Fig. 2. Monthly weather parameters data recorded at Anand during crop season, *Rabi* 2017-18.

The crop was hand harvested by sickle four times i.e. 60, 85, 110 and 135 days after sowing (DAS) in each growing season from net plot area of 12.3 m^2 (4.1 x 3 m) at harvest. The plants were cut 5 cm above the ground. After harvest, green fodder yield and yield parameters were recorded from net plot area. Two spots of 1.0 m row length were identified to record number of tillers per meter row length. From same area 20 tillers were sampled randomly and harvested from

ground level to record plant height, no. of trifoliate leaves and dry matter accumulation per tiller. 20 tiller samples sundried for few days before being kept in oven at 70°C for 3 successive days to a constant stable weight for estimation of dry weight (g).

After recording green fodder yield from net plot area, 500 gram chopped mixed fodder samples 1 to 2 cm size consisting of leaves and stem portion was taken and sundried for few days. Sundried samples were kept in oven separately at 70°C for 3 successive days to a constant stable weight. The obtained weights were considered as dry weight percentages (%) of dry matter production (t/ha) for each treatment. Thereafter, dry samples were fine grinded (1 mm) for chemical analysis. Amount of nitrogen (N) and crude protein content was estimated by using IS/ISO 5983-2 (2005). Proximate analysis of silage samples was carried out following the standard laboratory procedures recommended by AOAC (2012). Mineral content was determined according to Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES), Perkin Elmer, OPTIMA-8000.

Total uptake of nutrients was calculated separately by the following formula:

Uptake of nutrient (kg/ha)=[Nutrient % × Dry matter yield (kg/ha)]/100

Whereas, nutrient uptake (kg/ton of dry matter) = (Nutrient uptake) / (Dry matter yield)

Two season's data was pooled and mean values of observations were analysed statistically according to Sheoran *et al.*, (1998)**.** Overall differences were tested by 'F' test of significance. The critical differences were worked out at 5 per cent level of probability for comparing treatment means in case of significant 'F' test.

RESULTS AND DISCUSSION

Forage yield

Pooled data of two year showed significant differences among berseem varieties for green fodder and dry matter yield (Table 1). The highest green fodder yield was recorded for HB-2 (55.91 t/ha), which was significantly higher than Wardan (national check) variety BB-3, BB-2, BL-10 and exotic berseem Miskawi. BB-3 variety recorded the lowest (40.46 t/ha) green fodder yield among all varieties. Berseem variety BL-42 at par with Wardan, BL-1, JB-5 and HB-2 recorded significantly highest dry matter (DM) yield of 10.73 t/ha, in comparison to rest of the indigenous varieties BB-3, BB-2, JB-1 and Egyptian variety Miskawi (Table 1). Significantly lowest dry matter yield (8.70 t/ha) was observed in BB-3 in comparison to Wardan (NC), BL-1, BL-42, and HB-2. Significant differences among berseem varieties for green and dry matter yields were also reported by Devi and Satpal (2019). Present two years study has conclusively proven superiority of many notified berseem varieties over exotic variety Miskawi with respect to green fodder yield and dry matter yield. This may be due to higher genetic potential and better adaptability of indigenously developed notified varieties to agro-climatic conditions in India. This may also be due to fact that Miskawi is the only genotype which is being used for the last 110 years as reported by Jindal *et al.*, 2014. Berseem variety HB-2 recorded higher crude protein yield (1.82 t/ha) than Wardan (NC) and exotic variety Miskawi, however, the differences were found to be non-significant (Table 1). Among berseem varieties mean green fodder, dry matter and crude protein yields ranged between 40.46-55.91, 8.70-10.71 and 1.35-1.82 t/ha, respectively (Table 1). Wasnik *et al.*, (2017) reported mean green yield of 31.05-42.89 t/ha in berseem variety Wardan in three cuttings. Godara *et. al.*, (2016) and Satpal *et al*., (2020) also observed significant variations among berseem genotypes for fodder yields and quality. Soleymani and Shahrajabian (2012b) have also reported variation in yield parameters amongst berseem cultivars.

Growth parameters

Among different growth parameters, berseem varieties were found to be significantly different amongst themselves for plant height only (Table 1). Variations due to cultivars in growth parameters and yield have also been reported by Faridullah *et al.*, (2008). Plant height at harvest was recorded higher for BL-1 (54.59 cm) that was significantly higher than national check variety Wardan, BB-3, BB-2, JB-1 and HB-2. Lowest plant height at harvest was observed in variety Wardan (49.72 cm). Non-significant differences were observed among BL-1, BL-42, JB-5 and Miskawi varieties for plant height at harvest. Non-significant differences were observed amongst berseem varieties for other growth parameters viz. biomass yield/tiller (g), number of trifoliate leaves/ tiller, dry matter accumulation/tiller (g) and number of tillers/ meter row length (Table 1). However, mean biomass yield/tiller (g), number of trifoliate leaves/

TABLE 1
Effect of varieties on growth parameters and yield potential of berseem (Pooled)

Varieties	Yield (t/ha)			Growth Parameters				
	Green fodder	Dry matter	Crude protein	Plant height (cm)	No. of trifoliate leaves/tiller	No. of tillers/ m row length	Biomass yield/tiller (g)	Dry Matter yield/tiller (g)
Wardan	48.81	10.31	1.70	49.72	7.31	68.26	3.95	0.93
BB-3	40.46	8.70	1.35	51.37	7.13	56.65	4.24	1.05
BB-2	41.33	8.99	1.40	51.44	7.34	64.90	4.16	0.97
BL-1	51.09	10.22	1.66	54.59	7.41	71.13	4.14	1.00
BL-10	48.14	9.63	1.65	53.22	7.37	76.32	3.94	0.95
BL-42	55.33	10.73	1.73	52.16	6.88	73.53	4.11	0.96
JB-1	52.46	9.34	1.57	48.27	7.08	73.53	3.46	0.95
Miskawi	44.56	9.34	1.51	52.77	7.23	79.19	4.37	0.96
JB-5	51.00	9.68	1.71	52.74	6.55	68.19	3.93	0.91
HB-2	55.91	10.16	1.82	50.17	7.30	74.75	3.93	0.94
S. Em±	2.22	0.41	0.10	0.97	0.23	4.64	0.17	0.05
C. D. (P=0.05)	6.66	1.22	NS	2.91	NS	NS	NS	NS

tiller, number of tillers /meter row length and dry matter yield/tiller (g) ranged between 3.46-4.37, 6.55-7.41, 56.65- 76.32 and 0.91-1.05, respectively. Differences in growth parameters may be due to genetic character of each variety.

Proximate parameters

Significant differences were observed among berseem varieties for proximate parameters (Table 2). Significantly higher dry matter (DM) content was recorded for variety BB-2 (21.73 %) while lowest DM content was recorded for JB-1 (17.79 %). DM content in variety BB-2 was found to be significantly higher than BL-42, JB-1, JB-5 and HB-2. Crude protein (CP) content was recorded significantly higher for HB-2 (17.93 %) as compared to Wardan, BB-3, BB-2, BL-1, BL-42, JB-1 and Miskawi. Lowest crude protein content was recorded for BB-3 (15.80 %). Our findings are in line with Godara *et al.*, (2016). Apart from HB-2, Miskawi (15.92 %) recorded significantly lower crude protein content than other two notified varieties viz. JB-5 (17.65 %) and BL-10 (17.30%). Crude fibre (CF) content was found significantly higher in BL-1 (23.30 %) as compared to Wardan (20.17 %), BB-3 (20.38 %), BB-2 (20.70 %) and JB-5 (20.26 %) varieties. Lowest CF fraction was recorded in national check variety Wardan (20.17%). Miskawi (2.15 %) recorded higher crude fat content but statistically at par with JB-5 (2.04), BB-3 (1.94), Wardan (1.92) and BL-1 (1.89) varieties and significantly higher in comparison to many notified varieties viz. BB-2 (1.60 %), BL-10 (1.74 %), BL-42 (1.87 %), JB-1 (1.58 %) and HB-2 (1.83 %). Variety JB-5 (1.30 %) recorded lowest silica content in comparison to Wardan, BL 1 and BL 10 (Table 2). Silica was recorded highest in BL-10 (2.66 %) which is significantly higher than all varieties except BL-1 (2.08 %). In 18 Egyptian berseem cultivars, average dry matter (14.43 %), crude protein content (20.08 %), crude fibre (23.60 %) and crude fat (2.41 %) was reported by (El-Nahrawy, 2014).

TABLE 2
Effect of varieties on proximate parameters content (%) in berseem. (Pooled)

Varieties	Dry matter	Crude protein	Crude fibre	Crude fat	Silica
Wardan	21.45	16.29	20.17	1.92	1.94
BB-3	21.56	15.80	20.38	1.94	1.62
BB-2	21.73	16.06	20.70	1.60	1.43
BL-1	20.10	16.41	23.30	1.89	2.08
BL-10	20.01	17.30	21.91	1.74	2.66
BL-42	19.41	16.23	22.62	1.87	1.33
JB-1	17.79	16.44	22.00	1.58	1.62
Miskawi	21.02	15.92	22.97	2.15	1.65
JB-5	19.00	17.65	20.26	2.04	1.30
HB-2	18.17	17.93	21.57	1.83	1.67
S. Em±	0.59	0.47	0.65	0.09	0.21
C. D. (P=0.05)	1.75	1.42	1.95	0.27	0.62

Nutrients content

Pooled data analysis showed significant differences among berseem varieties for macro-nutrients nitrogen (N) and calcium (Ca) and; micro-nutrients copper (Cu), zinc (Zn), iron (Fe) and manganese (Mn). Significantly higher N content was recorded in HB-2 (2.87 %) and lowest for BB-3 (2.53 %) among all varieties (Table 3). However, HB-2 variety was found to be at par with JB-5 (2.82%) and BL-10 (2.77%) for N content. Berseem varieties were found to be at par amongst themselves for P, K, Mg and S content (Table 3). Significantly higher Ca content was recorded for variety JB-5 (1.53 %) but at par with few berseem varieties HB-2 (1.52 %), BL-1 (1.39 %) and BL-42 (1.39 %). Lowest calcium content was observed among two varieties BB-3 and BB-2 (1.24 %). Macro-nutrients content viz. P, K, Mg and S varied non-significantly among berseem varieties ranging between 0.32-0.34, 1.23-1.63, 0.42-0.47 and 0.24-0.29 %, respectively.

Highest Cu was recorded for Miskawi (16.05 ppm) which was significantly higher than all varieties. Berseem variety HB-2 (42.73 ppm) statistically at par with JB-1 (35.30 ppm) recorded significantly higher Zn content as compared to all varieties including Wardan and Miskawi. Lowest Zn content was found in case of JB-5 (25.80 ppm). Iron was found significantly higher in BL-10 (1013 ppm) in comparison to other varieties but at par with BL-1 (906 ppm) and JB-1 (899 ppm). Manganese was significantly higher for JB-5 (67.14 ppm) and at par with BL-10 (60.35 ppm), JB-1 (63.24 ppm) & HB-2 (65 ppm). Except for Cu, notified berseem varieties were found to be significantly higher in macro & micro nutrients content (N, Ca, Zn, Fe and Mn) in comparison to Miskawi (Table 3).

Nutrient uptake

Pooled analysis of two years recorded significant differences among berseem varieties for macro and micro nutrient uptake (Table 4). However differences were found significant for calcium (Ca), Zinc (Zn), manganese (Mn) and copper (Cu) uptake only. Among berseem varieties, uptake of primary nutrients N, P_2O_5 and K_2O were found non-significant, however, it ranged between 219.64-291.52, 67.28 to 80.77 and 133.76-185.54 kg/ha, respectively. Karmaka**r** *et al.,* (2014) reported 270 kg N/ha uptake by berseem variety Wardan. Sardana and Narwal (1999) recorded N uptake in berseem cultivar between 219.2 -250 kg/ha. Ca uptake was significantly higher for HB-2 (154.35 kg/ha) than Miskawi, BB-3, BB-2, BL-10 and JB varieties. Lowest Ca uptake was recorded for BB-3 (107.27 kg/ha). Magnesium and sulphur uptake differed non-significantly among varieties but varied between 36.60- 46.42 and 22.06 - 28.97 kg/ha, respectively (Table 4). Zinc uptake was found to be significantly higher for HB-2 (434.39 g/ha) but at par with BL-42 (341.82 kg/ha) and BL-1 (342.41 kg/ha) varieties. Similarly, Mn uptake was also significantly higher for HB-2 (661.70 g/ha) in comparison to Miskawi, BB-2, BB-3 and Wardan varieties. Cu uptake was recorded significantly higher in case of Miskawi (149.63 g/ha) but at par with many

TABLE 3
Effect of varieties on macro and micro nutrient content in berseem. (Pooled)

Varieties	Macro-nutrient content (%)					Micro-nutrient content (ppm)				
	N	P	K	Ca	Mg	S	Cu	Zn	Fe	Mn
Wardan	2.61	0.34	1.39	1.31	0.45	0.27	10.99	31.68	667.13	52.40
BB-3	2.53	0.34	1.29	1.24	0.43	0.25	10.29	27.43	601.24	50.71
BB-2	2.57	0.33	1.23	1.24	0.42	0.24	10.19	30.20	604.02	47.39
BL-1	2.63	0.32	1.25	1.39	0.44	0.26	12.10	33.49	906.12	56.86
BL-10	2.77	0.34	1.37	1.32	0.44	0.27	11.08	31.95	1013.24	60.35
BL-42	2.60	0.33	1.38	1.39	0.42	0.27	11.42	31.99	674.58	54.33
JB-1	2.63	0.33	1.63	1.33	0.47	0.28	13.33	35.30	899.37	63.24
Miskawi	2.55	0.32	1.23	1.26	0.45	0.26	16.05	28.34	614.95	49.84
JB-5	2.82	0.34	1.31	1.53	0.44	0.29	9.61	25.80	651.98	67.14
HB-2	2.87	0.34	1.29	1.52	0.44	0.29	12.12	42.73	508.85	65.00
S. Em±	0.08	0.01	0.09	0.05	0.01	0.01	0.71	2.83	94.83	2.83
C. D. (P=0.05)	0.23	NS	NS	0.14	NS	NS	2.13	8.48	283.94	8.47

TABLE 4
Effect of varieties on macro and micro-nutrient uptake in berseem. (Pooled)

Varieties	Macro-nutrient Uptake (kg/ha)					Micro-nutrient Uptake (g/ha)				
	N	P_2O_5	K_2O	Ca	Mg	S	Zn	Fe	Mn	Cu
Wardan	269.56	80.33	171.85	135.30	46.42	27.75	328.82	6910.85	540.20	114.02
BB-3	219.64	68.67	133.76	107.27	37.60	22.06	238.00	5213.33	439.92	89.54
BB-2	231.16	67.28	134.16	111.77	38.23	22.20	274.80	5516.33	430.72	92.27
BL-1	268.27	74.23	152.45	141.79	45.36	26.48	342.41	9255.05	580.50	123.61
BL-10	266.84	76.22	160.66	127.95	42.39	26.19	309.52	9946.93	584.79	106.89
BL-42	279.24	80.77	177.01	148.93	45.05	28.47	341.82	7247.91	581.73	122.67
JB-1	246.46	71.53	185.54	125.07	43.79	25.84	329.44	8375.04	589.56	125.58
Miskawi	237.71	68.51	137.04	117.97	42.06	24.38	263.88	5707.83	463.95	149.63
JB-5	273.09	74.61	150.47	147.09	41.97	27.66	248.92	6313.49	647.54	93.11
HB-2	291.52	78.44	156.82	154.35	44.78	28.97	434.39	5176.13	661.70	123.30
S. Em±	15.36	4.84	14.29	7.37	2.12	1.71	33.69	1114.19	38.19	9.91
C. D. (P=0.05)	NS	NS	NS	22.07	NS	NS	100.87	NS	114.34	29.68

notified varieties viz. HB-2, JB-1, BL-42 and BL-1(Table 4). Fe uptake varied non-significantly among berseem varieties between 5176- 9946 g/ha. Tandon (2009) reported that berseem crop yielding 112 ton/ ha green fodder absorbed 980 g (Zn), 650 g (Fe), 580 (Mn) and 95 g (Cu).

Nutrients uptake per ton of dry matter production

Significant differences for macro-nutrient uptake per ton of dry matter yield among berseem varieties were observed for Nitrogen (N) and calcium (Ca) only (Table 5). N uptake (kg/ton) of dry matter yield was significantly higher for berseem variety HB-2 (28.69) which was at par with other notified berseem varieties JB-5 (28.24) and BL-10 (27.67) but significantly greater than Miskawi. Ca uptake (kg/ton) of dry matter yield was found to be significantly higher for berseem variety JB-5 (15.25) in comparison to few notified varieties and Miskawi but at par with remaining berseem varieties viz. HB-2, BL-1 and BL-42. Non-significant differences were observed among berseem varieties for K_2O, P_2O_5, Mg and S uptake that ranged between 14.76-19.59, 7.26-7.90, 4.21-4.68 and 2.44-2.86 kg/ton of dry matter yield, respectively (Table 5). Micro-nutrients Zn, Fe, Mn and Cu uptake per kg of dry matter production varied significantly in berseem varieties (Table 5). Highest Zn uptake gram

TABLE 5
Effect of varieties on macro and micro-nutrient uptake on berseem. (Pooled)

Varieties	Macro-nutrient uptake (kg/ton) of dry matter yield					Micro-nutrient uptake (g/ton) of dry matter yield				
	N	K_2O	P_2O_5	Ca	Mg	S	Zn	Fe	Mn	Cu
Wardan	26.06	16.66	7.76	13.13	4.52	2.68	31.68	667.13	52.40	10.99
BB-3	25.27	15.45	7.90	12.36	4.33	2.54	27.43	601.24	50.71	10.29
BB-2	25.69	14.75	7.48	12.38	4.23	2.44	30.20	604.02	47.39	10.19
BL-1	26.25	14.94	7.26	13.88	4.44	2.59	33.49	906.12	56.86	12.10
BL-10	27.67	16.49	7.90	13.24	4.38	2.71	31.95	1013.24	60.35	11.08
BL-42	25.96	16.58	7.51	13.93	4.21	2.66	31.99	674.58	54.33	11.42
JB-1	26.30	19.59	7.61	13.33	4.68	2.76	35.30	899.37	63.24	13.33
Miskawi	25.48	14.76	7.34	12.64	4.50	2.62	28.34	614.95	49.84	16.05
JB-5	28.24	15.67	7.72	15.25	4.36	2.86	25.80	651.98	67.14	9.61
HB-2	28.69	15.43	7.72	15.16	4.40	2.85	42.73	508.85	65.00	12.12
S. Em±	0.76	1.10	0.28	0.43	0.14	0.09	2.83	94.83	2.83	0.71
C. D. (P=0.05)	2.27	NS	NS	1.43	NS	NS	8.48	283.94	8.47	2.13

(g) per ton of dry matter yield was recorded in berseem variety HB-2 (42.73) but at par with JB-1 (35.30). Significantly higher Fe uptake g per ton of dry matter yield was recorded in BL-10 (1013.24) which was found to be at par with BL-1 (906.12) and JB-1 (899.37). Berseem variety JB-5 recorded highest Mn uptake (67.14 g/ ton of dry matter yield) but was found to be statistically at par with other berseem varieties HB-2, JB-1 and BL-10. Cu uptake g/ton of dry matter yield was found significantly highest in Miskawi (16.05) as compared to all other varieties. Roy and Srivastava (1988) reported micronutrient uptake by berseem per ton of dry matter yield was 87.5 g (Zn), 52.0 g (Mn), 58.0 g (Fe) and 8.5 g (Cu).

CONCLUSION

Two year trial results indicated the superiority of many notified berseem varieties over exotic Miskawi variety with respect to green fodder and dry matter yield which may be due to higher genetic potential and better adaptability of these varieties to agro-climatic conditions in India. Two notified varieties Hisar Berseem-2 (HB-2) and Berseem Ludhiana-42 (BL-42) were found to be best for cultivation under agro-climatic conditions of central Gujarat that recorded mean green fodder yield (55.62 t/ha), dry matter yield (10.45 t/ha) and crude protein content (17.08 %), that was found to be higher than exotic Miskawi variety by 19.88 %, 10.62 % and 6.79 %, respectively. It can be also be concluded from this study that indigenously developed and notified varieties of berseem are better in fodder production and quality than imported exotic Miskawi variety, hence, thrust must be given to increase seed production of notified varieties in the country in the larger interest of dairy farmers and seed producers.

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