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POTENTIAL OF MAIZE CULTIVARS FOR NUTRIENTS, YIELD AND SILAGE QUALITY

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SUMMARY

An experiment was carried out during two seasons *i.e. Zaid* 2018 and *Kharif 2018* to estimate the potential of 15 popular maize cultivars PMC-6, Narmada Moti, GM-6, African Tall, NK-6850, NK-6668, S-6668+, DKC-9081, P-3396, P-3502, HQPM-4, HQPM-1 PMH-1, PHM-3 and IIMR-1502 at fodder demonstration unit (FDU) of National Dairy Development Board, Anand (Gujarat) for fodder yield, nutrients and silage quality. The experiment was laid out in randomized block design (RBD) with 15 treatments and replicated thrice. The maize crop was grown at 60 cm x 20 cm spacing following recommend agronomic practices in order to maximize biomass yield and fodder quality and harvested at milk to dough stage. Two season's data were pooled for statistical analysis. National Check fodder maize composite African Tall (38.96 t/ha) statistically at par with PMC-6 (35.05 t/ha), S-6668+ (34.86 t/ha) and NK-6668 (34.10t/ha) recorded highest green fodder yield. African Tall (13.58 t/ha) also recorded highest dry matter yield, but was found statistically at par with PMH-1 (13.14 t/ha), NK-6668 (12.68 t/ha) and PMC-6 (12.53 t/ha) cultivars. Highest digestible dry matter yield was recorded for PMH-1 (7.98 t/ha) however, at par with African Tall (7.20 t/ha) and S-6668+ (7.19 t/ha) cultivars. Significantly higher crude protein yield was recorded in African Tall T (1.19 t/ha) that was found to be statistically at par with PMC-6 (1.06 t/ha), NK-6668 (1.01 t/ha) and S-6668+ (1.00 t/ha) cultivars. Quality parameters in maize silage viz. dry matter, crude protein, ether extract, acid insoluble ash, Brix and pH ranged from 34.20-44.41%, 7.26-9.33%, 0.62-2.77%, 5.30-7.86%, 8.51-11.22% and 3.81-4.45% respectively. PMH-1 (44.41%) recorded highest dry matter. Highest crude protein was observed in P-3396 (9.33%), followed by HQPM-1 (9.13 %), PHM-3 (8.64%) and HQPM-4 (8.61%) in hybrids. Significantly lower pH was recorded in PMC-6 (3.81) but statistically at par with NK-6850 (3.96), AT (3.99), S-6668+ (4.00), NM (4.02), PHM-3 (4.03), DKC-9081 (4.06). N, K, Total digestible nutrients and Total Ash content varied from varied from 1.21-1.49%, 0.92 to 1.44%, 47.90 to 73.76% and 4.25-7.79%, respectively in maize silage.

Key words : Maize, cultivars, fodder, yield, silage, quality, nutrients, uptake

Maize (*Zea mays* L.) is one of the most versatile crop having wider adaptability under varied agro-climatic conditions. Globally, maize is known as queen of cereals (Kumar *et al.,* 2021) because it has the highest genetic yield potential among the cereals. In India, Maize is a popular cereal crop cultivated in 9.2 million ha area for starch, livestock & poultry feed, food, fodder and industrial purposes. Pandey and Roy (2011) reported that maize is exclusively grown as a fodder crop in 0.9 million hectares area in India. Among different fodder crops cultivated in India, maize is of great importance and quite famous among dairy farmers because of some superior characters like quick growth nature, wider adaptability, high biomass, free from anti-nutritional components, high palatability and digestibility (Arya *et al.,* 2015). It also holds sufficient nutritional quality as compared to other non-leguminous fodders (Mahdi *et al*., 2011). Maize, being one of the most adaptable emerging crops having wider adaptability under varied agro-climatic conditions, has been proved superior in terms of green fodder quality and silage making, as it provides very palatable, highly succulent and nutritionally rich fodder to livestock which is free from anti-metabolites (Kumar *et. al*., 2020).

Maize has emerged as the most ideal crop for silage making (ensiling) as its fodder is rich source of easily fermentable water soluble carbohydrates (WSC) like fructose, fructans, sucrose, glucose and consists of lower buffering capacities of 200-250 mE/kg of dry matter (McDonald *et. al*., 1991). Ensiling is a growing practice worldwide, allowing a moist forage to be preserved until fed to livestock. Preservation is due to a combination of three factors: an oxygen-free environment, a low pH and fermentation products (lactic and acetic acids). The low pH and acids are the results of the fermentation of sugars by lactic acid bacteria naturally present on the crop. Over decades, India is facing continuous shortage of quality fodder to the tune of 50-60% resulting in low milk productivity of animals in comparison to world, therefore, adoption of silage making technology on large scale may play a crucial role in filling the wide gap between availability and requirement of quality green roughages for milch animals. Maize silage has huge potential with current market size of 4 to 5 million tons. With roughly 4.5% growth rate of dairy sector, silage business is going to play an important role. Silage maize with duration of around 80 days can increase the cropping intensity significantly and help in doubling farmers' income (Rakshit *et. al.*, 2021).

There are several factors which affect quantity and quality of silage production however the selection of maize cultivar (composite or hybrid) for cultivation is the most important factor due to genetics. Hybrid selection is a key to improve forage quality for optimum animal output (Widdicombe and Thelen, 2002). Bamboriya *et al.* (2020) have also pointed that improved high yielding cultivars coupled with better crop management is bound to increase productivity of maize in India. The information regarding the performance of different kinds of maize cultivars for fodder yield, nutrient content and silage quality under Central Gujarat condition is, however, limited. Therefore, this present study was undertaken with the objectives to find out the most suitable maize cultivars for green fodder production and ensiling purpose.

MATERIALS AND METHODS

The experiment was undertaken during two seasons i.e. *Zaid* 2018 and *Kharif* 2018 at fodder demonstration unit (FDU) of National Dairy Development Board, Anand (Gujarat) situated at 22° 33' N latitude and 72° 57' E longitude at an elevation of 41 meter above mean sea level. The soil of the experimental site was loamy in texture with EC (0.28), pH (8.05), total nitrogen (760.00 kg/ha), available phosphorus (80.69 kg/ha) and available potash (325.00 kg/ha). The soil contained DTPA-extractable Fe (5.30 ppm), Mn (3.32 ppm), Zn (1.46 ppm), available S (5.07 ppm) and Cu (0.82 ppm). During *Zaid 2018* season, crop was sown manually on 28th Feb, 2018 and harvested on 15th May, 2018. Whereas during *Kharif 2018* season; crop was sown on 10th July, 2018 and harvested on 12th October, 2018. The experiment was laid out in randomized block design (RBD) with three replications consisting of fifteen maize cultivars. Out of 15 cultivars of maize, 4 were composites viz. African Tall (AT) and Pratap Makka Chari-6 (PMC-6), Narmada Moti (NM) and Gujarat Makai-6 (GM-6). AT and PMC-6 were exclusively fodder type. 11 grain type hybrid maize cultivars studied in the trial were NK-6850, NK-6668, S-6668+, DKC-9081, P-3396, P-3502, HQPM-4, High Quality Protein Maize-1 (HQPM-1), High Quality Protein Maize-4 (HQPM-4), Punjab Maize Hybrid-1 (PMH-1), Pratap Hybrid Maize-3 (PHM-3), and IIMR-1502. In this trial, maize cultivars were compared with national check cultivar African Tall for yield and quality parameters.

The total plot size was 5.0 metre x 4.0 metre with net plot area of 3.0 m x 2.8 m (8.4 m^2) at harvest. The crop was sown at seed rate of 20 kg/ha at row spacing of 60 cm x 20 cm. After sowing, the plots were immediately irrigated for proper germination. All other agronomic practices like irrigation, hoeing, weeding, inter culturing etc. were carried out similar for all plots to exploit full potential of the tested cultivars. Each plot was fertilized with 5 ton/ha farm yard manure, 220 kg/ha N, 40 kg/ha P_2O_5 and 60 kg/ha K_2O. Full dose of farm yard manure, phosphorus, potassium manure and one-third dose of nitrogen using Single Super Phosphate, Ammonium Sulphate, and Murate of Potash fertilizer, respectively were applied as basal. Remaining nitrogen fertilizer was top dressed in equal doses at 30 & 45 days after sowing in maize rows as band placement. To control weeds, atrazine herbicide was applied as pre-emergence @ 0.75 Kg a.i./ha followed by hand weeding and earthing up operation at 25 days after sowing. Optimum moisture level was maintained during crop growing duration by surface irrigations. Insect's population was kept in check through soil application of insecticide phorate 10 G @ 12 kg/ha at sowing and whorl application in maize plants at 30 days stage. Two tank sprays of chlorpyrifos 50% EC + cypermethrin 5% EC @ 500 ml/ha at 20 days and imidacloprid 17.8% SL @ 5 ml/15 litre of water at 40 days stage was given. The crop was harvested at optimum dry matter content for ensiling at around 90 days duration for recording of growth, yield and quality components related to fodder.

Yield of fodder and growth attributes were measured and analysed at harvest for both the seasons.

From each net plot area, total number of plants at two randomly selected spots of 3.0 meter row length were counted and average out as number of plants per meter row length. Growth data was recorded from six randomly selected plants from same area. After harvest, growth parameters, brix content (°brix) and biomass yield of every treatment was determined. Brix content (°brix) was recorded from same six plants by using hand refractometer. 300 gram chopped green fodder samples were dried in oven separately at 75°C to achieve constant weight for dry matter content. Plot wise fresh fodder yield was multiplied by respective dry matter content (%) to get dry weight in kg per plot and was expressed dry matter yield in ton per hectare (t/ha).

The goal of making silage is to produce a stable feed with a high recovery of dry matter, energy, and highly digestible nutrients compared with the fresh crop. Microbial fermentation in the silo produces an array of end products and can change many nutritive aspects of a forage, hence due procedures were followed to make silage as suggested by Muck and Kung (2007). For ensiling purpose, randomly selected fodder from each treatment was chaffed by using 2 HP power chaff cutter to 1-2 cm length. Well mixed chaffed fodder was tightly filled, compacted and sealed manually in air tight plastic containers of 8 kg capacity for ensiling without use of any culture or additives in as such conditions.

After 45 days, sealed containers were opened and chemical analysis of silage samples were done for pH, proximate parameters, nutrient content and digestibility. pH of silage was recorded on the basis of fresh sample by using hand held pH meter. Plot wise 50 gram of silage sample was mixed in 150 ml of distilled water in a glass beaker. After 10 minutes, sensor of hand held pH meter was dipped in silage solution to record pH reading. 300 gram silage samples were oven dried at 75°C for 48 hours to achieve constant weight for dry matter content and thereafter, fine grinded (1 mm) for lab analysis. Total nitrogen (N) and crude protein content was estimated by using ISO 5983-2 (2009). 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. The Total soluble solids (TSS°) brix was estimated by placing a drop of stem juice on the surface of the hand refractometer.

For in vitro studies, rumen liquor was collected from rumen of an adult cow, strained through a 4–layered muslin cloth which was used as inoculum source. About 200 mg of feed sample was taken in a glass syringe and 30 ml of mixed buffered rumen liquor was added and incubated for 24 h, in a water bath at 39°C. Gas measurements were carried out at 0, 2, 4, 6, 8, 10, 12 and 24 h after incubation. Incubations were stopped at 24 h by dipping the syringes in cold water. All the determinations were carried out in triplicate. ME value calculated by using the prediction equations of Menke and Steingass (1988), whereas, total digestible nutrients (TDN) was calculated from metabolizable energy (ME) value as per the equation of NRC (1989). The In-vitro dry matter digestibility (IVDMD) was estimated as per method of Tilley and Terry (1963).

$$ME\ (MJ/kg\ DM) = 2.2 + 0.1357\ (GP24h) + 0.0057\ (CP) + 0.0002859\ (EE)^2$$

Where,

ME=metabolizable energy;

GP=gas production at 24 h incubation time;

CP=crude protein content (g/kg)

EE=ether extract (crude fat) content of the forage (g/kg).

$$ME\ (MCal/kg\ DM) = ME\ (MJ/kg\ DM)/4.184$$

TDN was calculated from ME value as per the following equation (NRC 1989).

$$TDN\ (\%) = [ME\ (MCal/kg\ DM) + 0.45]/0.0445309$$

Dry matter digestibility was calculated from the difference of the dry weight of sample and corrected weight of residues remained in the bag after incubation over dry weight of sample. Two season's data for growth, yield, proximate and nutrients content was pooled and statistically analysed by ANOVA (analysis of variance) as method given by Sheron *et al.* (1998). Treatments means were compared at 5% level of LSD (least significant difference).

RESULTS AND DISCUSSION

Pooled analysis of two season data showed significant difference in plant height among composites and hybrids. National check maize composite AT recorded maximum plant height (294.12 cm) whereas NM recorded lowest plant height (189.73 cm). Differences between 11 maize hybrids for plant height were found to be non-significant (Table 1). Stem

TABLE 1

Effect of cultivars on growth and yield of maize crop. (Pooled means of two seasons)

Treatments	Plant height	Stem girth	No. of leaves/ plant	Green cob wt. plant (kg)	Cob : Plant weight ratio at harvest	Dry Matter Accumulation/ plant (g)	Green fodder yield (GFY)	Dry matter ykeld (DMY)	Digestible dry matter yield	Crude protein yield (CPY)	Ether extract yield (EEY)	Crude fibre yield (CFY)
Composites	(cm)								(t/ha)			
PMC-6	268.90	6.07	8.62	0.17	0.25	259.42	35.05	12.53	7.06	1.06	0.18	2.16
Narmada Moti	189.73	5.21	8.05	0.11	0.31	152.86	17.48	7.63	5.29	0.63	0.23	1.46
GM-6	196.71	5.61	8.56	0.23	0.31	161.49	19.46	7.56	4.30	0.63	0.10	1.27
African Tall (NC)	294.12	6.81	8.82	0.26	0.32	327.70	38.96	13.58	7.20	1.19	0.09	2.75
Hybrids												
NK-6850	199.64	5.90	8.00	0.24	0.42	202.61	30.34	11.37	6.46	0.81	0.17	1.94
NK-6668	216.70	6.34	8.23	0.24	0.39	238.86	34.10	12.68	7.08	1.01	0.26	1.97
S-6668+	213.87	5.95	8.18	0.23	0.37	221.87	34.86	12.25	7.19	1.00	0.23	2.19
DKC-9081	216.06	6.07	7.52	0.28	0.43	227.86	27.26	9.30	5.67	0.76	0.14	1.91
P-3396	205.79	6.22	7.99	0.23	0.43	194.15	27.23	9.71	6.50	0.96	0.14	1.77
P-3502	210.95	5.77	7.10	0.23	0.43	190.29	27.05	8.26	4.54	0.67	0.16	1.38
HQPM-4	220.02	6.25	8.30	0.18	0.34	209.45	28.70	11.33	6.34	0.97	0.24	1.77
HQPM-1	201.66	6.16	7.99	0.18	0.34	212.67	25.18	9.72	5.72	0.90	0.21	1.64
PMH-1	242.16	5.74	8.23	0.20	0.36	260.22	29.97	13.14	7.98	0.99	0.29	2.16
PHM-3	222.02	5.95	8.77	0.23	0.31	312.83	23.42	9.03	5.59	0.81	0.19	1.66
IIMR-1502	191.49	6.19	8.51	0.18	0.40	196.47	24.95	10.59	6.72	0.80	0.16	1.60
S. Em±	5.47	0.20	0.25	0.02	0.03	24.33	2.15	0.90	0.53	0.08	0.02	0.16
C. D. (P=0.05)	15.94	0.57	0.74	0.06	0.08	70.85	6.25	2.61	1.53	0.22	0.05	0.45

NC : National Check.

girth varied significantly from 5.21 to 6.81 cm, NM recorded lowest while AT recorded maximum stem girth. Same finding were reported by Kumar *et al.* (2016) for fodder composite AT. Significantly lower number of leaves per plant was observed for P-3502 (7.10) and higher for AT (8.82) which was at par with PHM-3 (8.77), PMC-6 (8.62), GM-6 (8.56), IIMR-1502 (8.51) cultivars. Green cob weight per plant also varied significantly from 0.11 kg to 0.28 kg. Highest green cob weight per plant was recorded for DKC-9081 (0.28 kg) and lowest for NM (0.11 kg). Cob to plant ratio at harvest varied significantly from 0.25 to 0.43 but at par within composites group and hybrids. Lowest cob to plant ratio was for PMC-6 (0.25) and highest for DKC-9081, P-3396, P-3502 (0.43). Dry matter accumulation per plant was recorded significantly higher for AT (327.70 g), while NM had lowest dry matter accumulation per plant (152.86 g). Dry matter accumulation per plant in PHM-3 (312.83 g) hybrid was at par with AT.

Statistical differences were found to significant for green fodder yield, dry matter yield, digestible dry matter yield, crude protein yield, ether extract yield and crude fibre yield among all cultivars (Table 1). National Check fodder maize composite AT (38.96 t/ha) statistically at par with PMC-6 (35.05 t/ha), S-6668+ (34.86 t/ha) and NK-6668 (34.10t/ha) recorded highest green fodder yield. NM (17.48 t/ha) recorded lowest green fodder yield but at par with GM-6 (19.46 t/ha) and PHM-3 (23.42 t/ha). AT (13.58 t/ha) recorded highest dry matter yield, but was found statistically at par with PMH-1 (13.14 t/ha), NK-6668 (12.68 t/ha) and PMC-6 (12.53 t/ha) cultivars. Significantly lower dry matter yield and digestible dry matter yield were found for composite GM-6, 7.56 t/ha and 4.30 t/ha, respectively. Biomass yield is a product of yield contributing parameters like plant height, stem girth and number of leaves per plant. Higher green fodder yield and dry matter yield in case of maize AT is also attributed from maximum plant height (294.12 cm), stem girth (6.81 cm) and highest number of leaves per plant (8.82). Kumar and Singh (2004) reported that the dry matter yield/plant is significantly and positively associated with green fodder yield and growth parameters such as plant height, number of leaves/plant and stem girth. Shanti *et al.* (2012) had also reported highest green fodder yield in AT grown for fodder purpose. Higher green fodder yield in AT was also reported by Bhagat *et al.* (2017). Highest digestible dry matter yield was recorded for PMH-1 (7.98 t/ha) however, at par with AT (7.20 t/ha) and S-6668+ (7.19 t/ha) cultivars. Significantly higher crude protein yield was recorded in AT (1.19 t/ha) that was found to be statistically at par with PMC-6 (1.06 t/ha), NK-6668 (1.01 t/ha) and S-6668+ (1.00 t/ha) cultivars. NM and GM-6 recorded lowest crude protein yield (0.63 t/ha). Mohan and Kurmi (2020) also recorded significant variation in crude protein yields in maize trial. Singh *et al*., (2020b) reported significant variation in GFY, DMY and CPY in 10 maize cultivars ranging between 21.36-40.54, 5.30-9.43 and 0.29-0.89 t/ha. Ether extract yield varied significantly from 0.09 to 0.29 t/ha among maize cultivars. Hybrid PMH-1 (0.29 t/ha) recorded highest ether extract yield whereas AT (0.09 t/ha) recorded lowest. Significantly higher crude fibre yield were recorded in AT (2.75 t/ha) and lower crude fibre yield was found in GM-6 (1.27 t/ha).

All the proximate parameters of maize silage differed significantly (Table 2). Quality parameters in silage viz. dry matter (DM), crude protein (CP), ether extract (EE), acid insoluble ash (AIA), Brix (total soluble sugar) and pH ranged from 34.20-44.41%, 7.26-9.33%, 0.62-2.77%, 5.30-7.86%, 8.51-11.22% and 3.81-4.45% respectively. Dry matter (%) is an important attribute to evaluate the quality of forage crops and it has a significant positive impact on the performance of dairy animals. PMH-1 (44.41%) recorded highest DM content across all cultivars, while DKC-9081 (34.20%) had lowest DM content. Similar results were also found by Saleem et al. (2007) who reported significant variation among the maize cultivars for dry matter. Highest crude protein was observed in P-3396 (9.33%), followed by HQPM-1 (9.13 %), PHM-3 (8.64%) and HQPM-4 (8.61%) in hybrids whereas NK-6850 (7.26%) reported lowest crude protein content. Basit *et al.* (2018) also reported significant differences in crude protein content between 9 maize cultivars ranging between 5.47-11.00%. Composite NM recorded significantly higher ether extract content (2.77%) followed by PMH-1 (2.32%). Whereas, AT (0.62%) recorded significantly lower ether extract content. Significantly higher AIA was reported in AT (7.86%) followed by P-3502 (7.40%) and PMC-6 (7.22%) but were at par amongst themselves. S-6668+ (5.30%) reported lowest AIA content. Hundai *et al.* (2020a) significant variation in maize silage for dry matter, crude protein, ether extract content ranging between 29.45-35.44%, 9.10-9.54% and 2.29-2.60%, respectively.

TSS or Brix represents the percentage by mass of total soluble solids of a pure aqueous sucrose solution. Higher °brix may indicate the availability of total soluble sugars (sucrose, glucose and fructose) in green fodder for rapid fermentation needed during ensiling process. In this trial, TSS content in stem juice of maize cultivars significantly varied from 8.51-11.22 at harvest (Table 2). GM-6 (11.22) statistically

TABLE 2

Effect of cultivars on chemical composition of maize silage. (Pooled means of two seasons)

Treatments	Dry Matter (DM) %	Crude Protein (CP) %	Ether Extract (EE) %	Acid Insoluble Ash (AIA) %	°Brix (TSS)	pH (As such basis)
Composites						
PMC-6	36.07	8.52	1.49	7.22	11.10	3.81
Narmada Moti	43.33	7.58	2.77	6.42	10.86	4.02
GM-6	39.85	7.90	1.23	6.01	11.22	4.14
African Tall (NC)	34.72	8.58	0.62	7.86	10.04	3.99
Hybrids						
NK-6850	37.64	7.26	1.53	5.93	10.08	3.96
NK-6668	36.90	8.47	2.14	6.64	9.86	4.20
S-6668+	34.55	8.39	1.92	5.30	10.11	4.00
DKC-9081	34.20	8.09	1.52	7.33	9.54	4.06
P-3396	35.63	9.33	1.41	5.99	9.79	4.30
P-3502	35.60	7.95	1.87	7.40	8.51	4.22
HQPM-4	39.39	8.61	2.16	6.29	10.23	4.25
HQPM-1	38.65	9.13	2.16	6.77	9.94	4.17
PMH-1	44.41	7.84	2.32	6.93	10.06	4.40
PHM-3	39.09	8.64	2.01	7.13	11.06	4.03
IIMR-1502	42.18	8.03	1.63	6.72	10.62	4.45
S. Em±	2.09	0.30	0.20	0.37	0.42	0.09
C. D. (P =0.05)	6.10	0.88	0.58	1.09	1.22	0.27

NC : National Check.

at par with PMC-6 (11.10) and PHM-3 (11.06) recorded significantly higher TSS content over remaining maize cultivars. pH of maize silage differed significantly due to cultivars effect (Table 2). Significantly lower pH was recorded in PMC-6 (3.81) but statistically at par with NK-6850 (3.96), AT (3.99), S-6668+ (4.00), NM (4.02), PHM-3 (4.03), DKC-9081 (4.06). Lower pH in silage indicates higher content of lactic acid as this acid is stronger than the other acids in silage (acetic, propionic and butyric), and therefore is usually responsible for most of the drop in silage pH as reported by Kung and Shaver (2001). Brar *et al.* (2019) reported that pH in 21 maize silage samples varied from 3.6 to 4.3.

Significant difference were observed in nutrient content in different maize cultivars silage (Table 3). N content varied from 1.21-1.49%. Maize hybrid P-3396 (1.49%) recorder highest N content while NM (1.21%) recorded lowest. Highest P content found in PHM-3 (0.32%) whereas lowest found in DKC-9082 (0.14%). K content varied from 0.92 to 1.44%. AT recorded highest K content whereas, S-6668+ recorded lowest. Similarly AT (0.29%) also recorded highest Ca content but lowest Ca content was observed in HQPM-4 (0.15%). Both PMC-6 and HQPM-1 recorded highest S content (0.14%) whereas, lowest (0.11%) was recorded in NM, P-3502, HQPM-4 cultivars. Micronutrient Zn was recorded highest for IIMR-1502 (43.47 ppm) however, NK-6850 (22.46 ppm) recorded lowest Zn content. N, P, K, Ca, S and Zn contents in maize cultivars were varied significantly ranging between 1.43-1.70%, 0.20-0.29%, 0.58-0.85%, 0.21-0.33%, 0.10-0.13% and 20.0-28.9 ppm respectively (Singh *et. al*., 2020a).

In-vitro dry matter digestibility (IVDMD), total digestible nutrients (TDN), crude fibre (CF) and total ash (TA) was estimated for different maize cultivars (Table 3). Maize cultivar IIMR-1502 (67.84%) recorded higher IVDMD whereas, AT (52.06%) recorded lowest IVDMD. Total digestible nutrients (TDN) varied from 47.90 to 73.76%. PMH-1(73.76%) recorded highest TDN followed by HQPM-4 (66.36%) whereas, AT (47.90%) recorded lowest TDN. Highest crude fibre content was observed in DKC-9081 (20.21%) whereas lowest crude fibre content was recorded for GM-6 (16.06%). Total ash content in maize cultivars varied between 4.25-7.79%. Higher total ash content was observed in AT and lowest in S-6668+. Results are in close conformity with Hundai *et al.* (2020b) who also reported that TDN, *In-vitro* true organic matter digestibility and ash content in 5 maize hybrids silage varied from 68.26-71.15%, 66.90-69.96% and 5.02-6.26%, respectively.

The pooled data analysis revealed significant

TABLE 3
Effect of cultivars on nutrients content and quality of maize silage

Treatments	Nutrient Content						Fodder Quality			
	N	P	K	Ca	S	Zn	In-Vitro Dry Matter Digestibility (IVDMD)	Total Digestible Nutrients (TDN)	Crude Fibre (CF)	Total Ash (TA)
Composites			%			ppm		%		
PMC-6	1.36	0.31	1.10	0.23	0.14	33.68	56.88	56.96	17.41	5.24
Narmada Moti	1.21	0.21	1.15	0.21	0.11	23.60	63.80	62.59	17.61	6.63
GM-6	1.26	0.27	1.06	0.17	0.12	24.87	54.24	54.34	16.06	5.45
African Tall (NC)	1.37	0.27	1.44	0.29	0.13	29.92	52.06	47.90	19.89	7.79
Hybrids										
NK-6850	1.16	0.24	1.19	0.19	0.12	22.46	57.67	58.97	17.30	5.50
NK-6668	1.36	0.25	0.98	0.16	0.13	23.43	59.17	63.73	16.50	5.10
S-6668+	1.34	0.27	0.92	0.16	0.12	30.36	60.13	63.75	18.31	4.25
DKC-9081	1.29	0.14	1.39	0.28	0.12	24.12	59.96	62.70	20.21	7.09
P-3396	1.49	0.24	1.15	0.16	0.12	27.14	63.49	65.55	17.25	5.14
P-3502	1.27	0.16	1.24	0.16	0.11	23.09	54.13	63.04	16.50	6.76
HQPM-4	1.38	0.26	0.96	0.15	0.11	25.05	56.41	66.36	15.72	4.54
HQPM-1	1.46	0.27	1.17	0.19	0.14	25.84	58.25	62.80	16.70	5.59
PMH-1	1.25	0.27	1.22	0.17	0.13	29.17	63.40	73.76	17.18	5.74
PHM-3	1.38	0.32	1.05	0.16	0.13	27.73	59.35	64.95	17.65	5.35
IIMR-1502	1.28	0.24	1.21	0.21	0.12	43.47	67.84	61.68	16.18	5.74

NC : National Check.

TABLE 4
Effect of cultivars on nutrients uptake of maize crop. (Pooled means of two seasons)

Treatments	Nutrients uptake (Kg/ha)					
Composites	N	P_2O_5	K_2O	Ca	S	Zn
PMC-6	169.16	86.78	164.39	28.43	17.63	418.22
Narmada Moti	100.50	39.88	114.80	17.40	9.12	195.57
GM-6	100.19	49.41	100.94	13.79	9.51	197.15
African Tall (NC)	189.84	85.29	240.20	40.13	17.85	414.05
Hybrids						
NK-6850	130.02	60.53	160.60	21.60	13.21	251.35
NK-6668	162.17	68.55	140.85	19.51	15.56	280.34
S-6668+	160.45	73.99	132.10	19.37	14.23	363.04
DKC-9081	122.32	30.32	158.02	26.46	11.15	227.93
P-3396	152.81	55.84	141.72	16.69	12.18	277.91
P-3502	106.63	30.95	124.90	13.51	8.98	193.68
HQPM-4	154.80	66.99	130.44	16.98	12.14	281.63
HQPM-1	143.35	61.42	138.39	18.26	13.94	253.70
PMH-1	157.87	77.86	184.97	21.77	16.36	367.12
PHM-3	130.18	67.97	118.66	15.35	12.24	261.13
IIMR-1502	127.24	54.24	144.84	20.40	11.78	430.54
S. Em±	12.02	5.59	11.75	1.74	1.17	25.54
C. D. (P =0.05)	34.99	16.27	34.21	5.06	3.39	74.37

NC : National Check.

differences among cultivars for macronutrients uptake viz. N, P_2O_5, K_2O, Ca and S (Table 4). Highest N uptake was recorded for cultivar AT (189.84 kg/ha), that contributed to its highest GFY and DMY as nitrogen imparts towards higher vegetative growth and biomass production. GM-6 recorded lowest N uptake (100.19 kg/ha) that sets also true as its DMY was recorded lowest. Similarly P_2O_5 uptake also varied significantly from 30.32 to 86.78 kg/ha, with highest P_2O_5 taken up by PMC-6 (86.78 kg/ha) and lowest for DKC-9081 (30.32 kg/ha). Amongst maize cultivars, K_2O uptake was found significantly higher in AT (240.20 kg/ha) and GM-6 (100.94 kg/ha) recorded lowest uptake. Ca uptake was recorded significantly higher in AT (40.13 kg/ha) in comparison to remaining cultivars. S uptake (17.85 kg/ha) was also observed significantly higher in AT. Lowest Ca and S uptake was recorded in composite P-3502 (13.51 kg/ha) and (8.98 kg/ha), respectively. Among maize cultivars, non-significant differences were recorded for Zn uptake (Table 4). Significantly higher Zn uptake was found in IIMR-1502 (430.54 g/ha) at par with PMC-6 (418.22 kg/ha), AT (414.05 g/ha), PMH-1 (367.12 g/ha) and S-6668+ (363.04 g/ha). Singh *et al.* (2020b) reported that nutrients uptake by maize crop significantly varied between 60.45-124.89 kg/ha, 26.84-44.49 kg/ha, 58.54-94.63 kg/ha, 11.43-25.05 kg/ha, 5.57-10.84 kg/ha, 247.87-357.34 g/ha for N, P_2O_5 and K_2O, Ca, S and Zn, respectively.

CONCLUSION

In this study, two season's pooled data indicated superior genetic potential in fodder type maize composites AT and PMC-6 for green fodder, dry matter, crude protein, digestible dry matter yields and silage quality but at par with few maize hybrids. Results indicated that few maize grain hybrids viz. NK-6850, NK-6668, S-6668+ and PMH-1 are most suitable for silage making. Therefore, it may be concluded from this study that under central Gujarat conditions, maize fodder composites AT, PMC-6 and maize grain hybrids NK-6850, NK-6668, S-6668+ and PMH-1 may be recommended for cultivation for silage purpose.

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