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# RELATIVE PERFORMANCE OF OAT FORAGE VARIETIES FOR SEED PRODUCTION, ECONOMICS AND FODDER YIELD UNDER CENTRAL GUJARAT CONDITIONS

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## SUMMARY

The field experiment was conducted in *Rabi* season during two consecutive years 2014-15 and 2015-16 at the fodder demonstration unit (FDU) of National Dairy Development Board, Anand (Gujarat) with the objective to evaluate different oat varieties for their seed yield, fodder yields and quality under Central Gujarat conditions. The experiment was designed in randomised block design with four replication and 13 treatments of oat varieties. The pooled data over the two years revealed that the oat varieties UPO 212 (41.15 t/ha) followed by OS 346 (41.10 t/ha) recorded significantly higher green fodder yield. Dry matter and crude protein yield was observed to be higher in oat varieties UPO 212 (9.10 t/ha) and JO-03-91 (1.18 t/ha), respectively. Oat variety Kent (1.66 t/ha) statistically at par with NDO 1 (1.53 t/ha) recorded significantly higher seed yield while the lowest seed yield was observed in oat variety RO 19 (0.53 t/ha). Test weight was significantly high in OS 346 (49.40 g) while Kent recorded lowest test weight (37.93 g). Harvest index % was recorded higher in Kent (12.33) followed by NDO 1 (12.22). Benefit:Cost (B:C) ratio for green fodder production was recorded highest equally (1.70) in UPO 212 and OS 346 followed by JO-03-91 (1.60). In seed production, B:C ratio was observed highest in oat variety Kent (2.51) followed by NDO 1 (2.14), JO-03-91 (1.75). Amongst different oat varieties crude protein content ranged between (10.49 to 13.14 %), crude fat (1.54 to 2.51 %), crude fibre (31.08 to 34.0%) and silica (2.54 to 3.68 %). Economic analysis shows that oat seed production provided greater returns as compared to green fodder production.

**Key words :** Oat, variety, green fodder, seed yield, crop residue, quality

Oat (*Avena sativa* L) is one of the most important cereal fodder crop grown during winter season in north-western, eastern and central parts of India under irrigated conditions. Oat is mainly cultivated for green fodder, hay, silage, and seed/grain purpose. After taking seed production, farmers feed oat straw to animals due to good nutritive value and palatability. Over the years, oat has become an important fodder crop and, due to continuous increase in its cultivated area, demand for improved varieties of oat has increased. In India, it is cultivated in states like Punjab, Haryana, Jammu & Kashmir, Himachal Pradesh, Uttar Pradesh, Uttarakhand, Madhya Pradesh, Chhattisgarh, Jharkhand, Rajasthan, Maharashtra, Gujarat, Odisha and West Bengal. The total area covered under Oat cultivation in the country is about 1.0 million ha with 35-50 t/ha green fodder yield (IGFRI, 2011). The crop occupies maximum area in Uttar Pradesh (34%), followed by Punjab (20%), Bihar (16%), Haryana (9%) and Madhya Pradesh (6%) (Agricultural Statistics, 2006-2007).

Due to the awareness created by milk unions, dairy farmers in Gujarat have now started cultivating oat for green fodder during winters along with Lucerne, fodder chicory & fodder beet. Indian Council of Agricultural Research (ICAR) has developed & notified several oat varieties for fodder cultivation under All-India Coordinated Research Project on Forage Crops and Utilisation coordinated by Indian Grassland and Fodder Research Institute, Jhansi. NDDB is playing a key role in cultivation of improved fodder varieties by coordinating fodder seed production through Dairy Cooperative run Fodder Seed Processing Unit. Timely introduction of improved fodder varieties in seed multiplication chain is very important for the benefit of dairy farmers. Before introducing new varieties for cultivation & seed production, information on its growth & quality parameters along with fodder & seed yield potential under local agro-climatic conditions is very much

needed for selecting the right variety for cultivation. Recently some new varieties of oat have been developed, which have the capacity to produce higher green and seed yield. However, limited information is available on the performance of these oat varieties under central Gujarat conditions for fodder yield, nutritive value and seed production. Keeping this in view, for the benefit of dairy farmers, seed growers and fodder seed production agencies under dairy cooperatives, the present study was conducted to evaluate different oat varieties for their fodder yields, quality, seed production and other associated characteristics.

## MATERIALS AND METHODS

The experiment was laid out in a randomized block design with four replications containing thirteen treatments of oat varieties namely JO-03-91, UPO 212, JHO 851, JHO 822, RO 19, JO 1, JHO 99-1, JHO 99-2, JHO 2004, NDO 1, OS 346, HJ 8 and Kent. Among the varieties, Kent was the oldest and widely adapted variety and considered as national check (NC) in forage oat research & developmental trials at national level. The study was undertaken during two consecutive years 2014-15 and 2015-16 at fodder demonstration unit (FDU) of National Dairy Development Board, Anand (Gujarat). The soil of the experimental site was loamy in texture with EC (0.19), pH (7.71), total nitrogen (899.63 kg ha $^{-1}$), available $P_2O_5$ (12.83 kg ha $^{-1}$) and available $K_2O$ (272.42 kg ha $^{-1}$). The soil contained DTPA-extractable Fe (5.81 ppm), Mn (4.33 ppm), Zn (1.83 ppm), available S (3.08 ppm) and Cu (1.37 ppm). The crop was sown manually on 25$^{th}$ November, 2014 and 4$^{th}$ December, 2015. The total plot size was 5.0 x 4.0 meter with net plot area of 4.0 x 3.0 meter at harvest. The crop was sown with a seed rate of 80 kg ha$^{-1}$ at row spacing of 25 cm. After sowing, the plots were immediately irrigated for proper germination. All the treatments were fertilized with recommended dose of fertilizers (150 kg N: P: 60 kg: 60 kg K ha$^{-1}$). The fertilizers were applied as per treatment with a half dose of nitrogen and full dose of phosphorus and potassium in the form of NPK and MOP as basal and the remaining half of nitrogen in form of urea was top dressed at 25 days & 45 days after sowing. After sowing, pendimethalin herbicide was applied as pre-emergence @ 1.0 litre ha$^{-1}$ to control seasonal weeds. In total 4 irrigations were given during the crop growth period. The crop was harvested at 90 day stage for green fodder yield and at complete maturity for seed yield.

Yield of fodder and seed, yield attributes and quality components of oat varieties were measured and analysed at harvest for both years. After harvest, fresh biomass yield of every treatment was determined and 500 gram chopped fodder samples were dried in ovens separately at 70°C to achieve constant weight for dry matter content. Plants from each net plot at two randomly selected spots of 1.0 metre row length were harvested and the tillers were counted and recorded as number of tillers per metre row length. Plant height of twenty randomly selected tillers from 1.0 metre row length was recorded and then harvested and partitioned into stem and leaf, sun-dried and finally oven-dried at 70°C to record dry matter accumulation in leaf and stem parts. Leaf to stem ratio (LSR) represents relation between mean dry weight of leaf and dry weight of stem. The leaf to stem ratio was worked out by applying the following formula.

$$\text{LSR} = \frac{\text{Leaf dry weight (g)}}{\text{Stem dry weight (g)}}$$

Dried samples were fine grinded (1 mm) for chemical analysis and the amount of N and crude protein content was estimated by using IS/ISO 5983-2 (2005). Proximate analysis of fodder samples for nutritive value 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. Biological and seed yields were recorded from net plot at maturity and simultaneously seed yield attributes were recorded from twenty randomly selected matured panicles with ripened seed. Harvest index and Benefit Cost ratio were calculated as per following formula.

$$\text{Harvest index} = \frac{\text{Seed yield}}{\text{Biological yield}} \times 100$$

Benefit Cost (B:C) Ratio = Net Monetary Return (NMR)/Cost of cultivation

Cost of fodder and seed cultivation was calculated on the basis of total variable cost. Two years data were pooled and mean values of observations were analysed statistically according to Sheron *et al.* (1998).

## RESULTS AND DISCUSSION

### Crop growth, yield & yield Attributes

The pooled data analysis showed significant difference among varieties for green fodder yield and Leaf to stem ratio (Table 1). Significantly, the differences among oat varieties were observed for green fodder yield only as oat varieties were found to be at par amongst themselves for dry matter and crude protein yields (Table 1). Oat varieties UPO 212 (41.15 t/ha) followed by OS 346 (41.10 t/ha) recorded significantly higher green fodder yield than RO 19, JO 1, HJ 8 and Kent. Superiority of UPO 212 over other oats varieties have been reported by earlier workers (Prajapati *et. al*., 2017). More green fodder production from oat variety OS 346 in comparison to zonal check JHO 822 and national check Kent in AICRP (Forage Crops) agronomic trials from 2006-07 to 2008-09 have been reported by Arora *et. al*., 2015. National check (NC) variety Kent, at par with RO 19 and HJ 8 recorded lowest green fodder yield (28.20 t/ha) amongst all oat varieties. Higher green fodder yield in UPO 212 may be attributed to more tillers per metre row length and plant height at harvest. Ahmed *et. al.* (2013) reported that green fodder yield in oat exhibited a significant positive genotypic correlation with number of tillers $m^{-1}$ row and plant height (cm). For dry matter yield, crude protein yield and dry matter content, oat varieties were observed to be statistically at par amongst themselves (Table 1). Dry matter and crude protein yield were observed to be higher in oat varieties UPO 212 (9.10 t/ha) and JO-03-91 (1.18 t/ha), respectively. Highest and lowest dry matter content was recorded in varieties JHO 822 (23.85%) and JHO 2004 (17.20%), respectively.

Amongst growth parameters, leaf to stem ratio (LSR) was found significantly higher in JHO 2004 (0.79) than other varieties but at par with RO 19, JO 1 and HJ 8 varieties (Table 1). Significantly lowest LSR was found in Kent (0.45). Saleem *et al.* (2015) also observed significant differences amongst oat varieties for LSR. Choudhary & Prabhu (2016) reported significantly higher LSR in oat variety JHO 99-2 (0.55) than JHO 99-1 (0.51). Among all varieties Kent recorded lower plant height although the differences were found to be non-significant. Due to significantly lower LSR and lowest plant height recorded in Kent variety may have contributed to lowest green fodder yield among all oat varieties. Krishna *et al.* (2014) reported that high positive correlation for green fodder yield was shown by leaf: stem ratio (0.433) followed by plant height (0.427).

### Crop Residue Yield, Seed Yield and Yield Attributes

At seed harvest stage, significant differences

TABLE 1

Influence of different oat varieties on fodder yield, seed yield and yield parameters (Pooled).

| Treatment | Green fodder yield (t/ha) | Dry matter yield (t/ha) | Crude protein yield (t/ha) | Dry matter content (%) | Plant height at fodder harvest (cm) | Leaf to stem ratio (L : S) | No. of tillers/ metre row length | Crop residue yield (t/ha) | Seed yield (t/ha) | 1000-grain weight | No. of sedd/ panicle | HI (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JO-03-91 | 39.65 | 9.01 | 1.18 | 23.15 | 113 | 0.48 | 59 | 12.49 | 1.16 | 38.26 | 52.29 | 8.29 |
| JHO 851 | 38.38 | 7.88 | 1.00 | 20.20 | 115 | 0.49 | 77 | 12.24 | 0.82 | 46.58 | 47.63 | 5.71 |
| JHO 822 | 37.00 | 8.68 | 1.03 | 23.85 | 118 | 0.51 | 65 | 14.14 | 1.07 | 49.23 | 45.96 | 9.02 |
| RO 19 | 33.94 | 7.10 | 0.95 | 21.28 | 120 | 0.74 | 76 | 12.84 | 0.53 | 41.65 | 48.00 | 4.12 |
| JO 1 | 34.73 | 8.10 | 0.99 | 23.70 | 112 | 0.62 | 75 | 10.79 | 1.10 | 43.56 | 61.83 | 7.13 |
| JHO 99-1 | 36.79 | 8.64 | 1.05 | 23.40 | 119 | 0.51 | 58 | 12.94 | 0.89 | 39.61 | 53.06 | 9.13 |
| JHO 99-2 | 35.79 | 8.15 | 0.96 | 22.53 | 117 | 0.58 | 59 | 11.23 | 1.11 | 39.97 | 40.29 | 9.86 |
| JHO 2004 | 38.69 | 6.59 | 0.89 | 17.20 | 121 | 0.79 | 71 | 11.71 | 0.91 | 48.25 | 51.29 | 7.39 |
| NDO 1 | 35.83 | 7.50 | 0.84 | 21.23 | 116 | 0.52 | 77 | 10.17 | 1.53 | 49.10 | 52.50 | 12.22 |
| OS 346 | 41.10 | 8.94 | 1.00 | 21.63 | 112 | 0.50 | 72 | 10.61 | 1.25 | 49.40 | 45.13 | 10.52 |
| HJ 8 | 32.96 | 7.32 | 0.77 | 22.88 | 119 | 0.61 | 68 | 11.03 | 1.05 | 45.75 | 50.03 | 10.44 |
| UPO 212 | 41.15 | 9.10 | 1.03 | 22.18 | 119 | 0.58 | 70 | 11.14 | 1.18 | 48.56 | 52.26 | 10.10 |
| KENT (NC) | 28.20 | 6.68 | 0.85 | 23.83 | 109 | 0.45 | 80 | 12.29 | 1.66 | 37.93 | 49.38 | 12.33 |
| Average | 36.48 | 7.98 | 0.97 | 22.08 | 116 | 0.57 | 70 | 11.81 | 1.10 | 44.45 | 49.97 | 8.94 |
| S Em± | 2.05 | 0.84 | 0.14 | 1.98 | 4 | 0.07 | 4 | 0.62 | 0.09 | 3.04 | 3.14 | 1.91 |
| C. D. (P=0.05) | 5.91 | NS | NS | NS | NS | 0.19 | 11 | 1.78 | 0.27 | 8.76 | NS | NS |

were observed among oat varieties for crop residue (CR) yield. Oat variety JHO 822 statistically at par with JO-03-91, RO 19 and JHO 99-1 significantly recorded higher CR yield (14.14 t/ha) than remaining oat varieties. Mean CR yield among oat varieties ranged from 10.17 to 14.14 t/ha. In a trial, Monika *et. al.* (2018) have recorded 12.17 t/ha straw yield in oat variety HJ 8 from seed to seed treatment. Significant differences among oat varieties were observed for seed yield, 1000 grain weight (test weight) and number of panicles/metre row length (Table 1). None of the varieties was able to out yield National Check (NC) variety Kent in seed yield. Oat variety Kent (1.66 t/ha) statistically at par with NDO 1 (1.53 t/ha) recorded significantly higher seed yield while the lowest seed yield was observed in oat variety RO 19 (0.53 t/ha). Siloriya *et al.* (2014) also reported higher seed yield in oat varieties Kent and NDO 1 in comparison, among six oat varieties. On an average oat varieties produced 1.10 t/ha of seed in the two year trial. High seed yielding oat varieties Kent and NDO 1, statistically at par amongst themselves, were found to be lowest in CR yields (Table 3). Among seed yield attributes, significant differences were noticed for test weight only. Test weight was significantly high in OS 346 (49.40 g) while Kent recorded lowest test weight (37.93 g). Number of tillers per meter row length was recorded significantly higher in Kent (80) than JO-03-91, JHO 822, JHO 99-1, HJ 8 and JHO 99-2 (Table 2). Higher number of tillers per metre row length may have contributed to higher seed yield in Kent. Kibite (1997) reported that seed yield of crop had strong possible correlation with number of panicles/m$^2$, weight of panicle and 1000 grain weight. Positive and significant correlations of grain yield with tillers per metre row length have been reported by Jaipal and Shekhawat (2016).

Non-significant differences were found for yield attributes viz. number of seed per panicle and harvest index %. However, JO 1 (61.83) and JHO 99-2 (40.29) recorded highest and lowest number of seed per panicle, respectively. Harvest Index (HI) % showing proportional value of seed yield over biological yield was recorded higher in Kent (12.33) followed by NDO 1 (12.22). Lowest HI was recorded in RO 19 (4.12).

**Economic Returns**

The cost of cultivation for green fodder production (Rs. 22855/ha) and seed production (Rs. 25955/ha) was same under all the treatments. The gross monetary return (GMR) is the value of the produce under different treatments. Since the quantity of produce (green fodder, seed and crop residue) varied due to the different treatments, hence GMR also varied with these treatments. Mean gross monetary return (GMR) and net monetary return (NMR), as well as

TABLE 2

Influence of different oat varieties on economic return (Rs./ha)

| Treatment | GMR (Green Fodder) | NMR (Green Fodder) | B : C ratio (Green fodder) | GMR (Seed Yield) | NMR (Crop Residue) | GMR (Seed+crop Residue) | NMR (Seed+crop Residue) | B : C ratio (Seed+crop Residue) |
|---|---|---|---|---|---|---|---|---|
| JO-03-91 | 59471 | 36616 | 1.60 | 46400 | 24975 | 71375 | 45420 | 1.75 |
| JHO 851 | 57563 | 34708 | 1.52 | 32900 | 24475 | 57375 | 31420 | 1.21 |
| JHO 822 | 55504 | 32649 | 1.43 | 42900 | 28270 | 71170 | 45215 | 1.74 |
| RO 19 | 50906 | 28051 | 1.23 | 21200 | 25670 | 46870 | 20915 | 0.81 |
| JO1 | 52095 | 29240 | 1.28 | 44100 | 21570 | 65670 | 39715 | 1.53 |
| JHO 99-1 | 55185 | 32330 | 1.41 | 35700 | 25880 | 61580 | 35625 | 1.37 |
| JHO 99-2 | 53689 | 30834 | 1.35 | 44200 | 22450 | 66650 | 40695 | 1.57 |
| JHO 2004 | 58028 | 35173 | 1.54 | 36300 | 23425 | 59725 | 33770 | 1.30 |
| NDO 1 | 53749 | 30894 | 1.35 | 61100 | 20330 | 81430 | 55475 | 2.14 |
| OS 346 | 61654 | 38799 | 1.70 | 50000 | 21215 | 71215 | 45260 | 1.74 |
| HJ 8 | 49436 | 26581 | 1.16 | 42000 | 22055 | 64055 | 38100 | 1.47 |
| UPO 212 | 61725 | 38870 | 1.70 | 47000 | 22275 | 69275 | 43320 | 1.67 |
| KENT | 42296 | 19441 | 0.85 | 66500 | 24580 | 91080 | 65125 | 2.51 |
| Average | 54715 | 31860 | 1.39 | 43869 | 23628 | 67498 | 41543 | 1.60 |

GMR-Gross monetary returns, NMR-Net monetary returns, B:C-Benefit-cost ratio. Cost of green fodder cultivation: Rs. 22855/ha, Cost of seed production: Rs. 25955/ha. (Selling price of green fodder- Rs. 1500/ton, seed-Rs. 40000/ton, Crop Residue- Rs. 2000/ton).

benefit-cost (B:C) ratio under oat seed production was found higher as compared to oat green fodder production (Table 2). The mean GMR, NMR and B:C ratio in seed crop was higher by 23.36, 30.39 and 15.12 per cent, respectively from green fodder crop. B:C ratio, among oat varieties for green fodder production was equally higher in UPO 212 and OS 346 (1.70) followed by JO-03-91 (1.60). Oat variety UPO 212 recorded highest net return (Rs. 38870/ha) closely followed by OS 346 (Rs. 38799/ha). Whereas, in oat seed production, B:C ratio was observed highest in oat variety Kent (2.51) followed by NDO 1 (2.14), JO-03-91 (1.75), JHO 822/OS 346 (1.74) and UPO 212 (1.67). Siloriya *et al.* (2014) also reported higher B:C ratio in oat varieties NDO 1 (2.84) and Kent (2.76). Whereas, B:C ratio (1.61) in oat variety JHO 822 seed production at farm level was reported by Kumar *et al.* (2013). Overall, mean NMR from oat varieties green fodder and seed production was Rs. 31860/ha and Rs. 41543/ha, respectively. Similarly mean B:C ratio from oat varieties green fodder and seed production was 1.39 and 1.60, respectively. The higher net returns and B:C ratio might be due to more returns from higher yield from green and seed production in different oat varieties. Economic analysis shows that oat seed production provided greater return as compared to green fodder production. Results are in conformity with Yadav *et al.* (2000).

**Proximate parameter and Mineral Content in Green Fodder**

In green fodder of oat varieties, statistical differences for proximate parameters and mineral content were found to be significant for silica and magnesium content only (Table 3). Among oat varieties, crude protein content ranged (10.49 to 13.14 %). Higher crude protein content was recorded in RO 19 (13.14 %) followed by JHO 2004 (13.01 %), while lowest was recorded in OS 346 (10.49%). Above 13 % crude protein content recorded in RO 19 and JHO 2004 may be attributed to higher leaf to stem ratio (LSR). However, crude protein contents did not differ significantly among the oat varieties**.** Similar results were also reported by **Habib *et al.* (2003)**. Crude fat content was observed highest in Kent (2.51%) and recorded lowest in NDO-1 (1.54%). Crude fibre content was observed highest in OS 346 (34.00 %) and recorded lowest in Kent (31.08 %). Oat variety, JHO 822 recorded significantly lowest silica content (2.54%) than UPO 212, JO 1, JHO 99-2 and JHO 2004 (3.68 %), which recorded significantly higher silica content. Mean silica content among oat variety ranged between 2.54 to 3.68 %. With respect to mineral content, Oat variety JHO 99-2 (0.34%) at par with other oat varieties recorded higher calcium content (Table 4). Phosphorus content was higher in few oat varieties JO 1, RO 19 and JHO 822 (0.28% equally) while lowest in JHO 99-2 and UPO-212 (0.24%). Magnesium content was recorded significantly higher in RO 19 (0.38%) than JHO 822, JO 1, JHO 99-1 and UPO 212 varieties and lowest was recorded in JO 1 and JHO 99-1 (0.30% each). Non-significant difference was recorded among oat varieties for sulphur, however, it was higher in RO 19 (0.42%) and lowest amount was recorded in NDO 1 (0.27%).

TABLE 3

Influence of different oat varieties on proximate parameters and mineral content in green fodder (Pooled)

| Treatment | Crude protein % | Crude fat % | Crude fibre % | Silica % | Ca % | P % | Mg % | S % | K % | Fe ppm | Cu ppm | Mn ppm | Zn ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JO-03-91 | 12.45 | 2.04 | 33.26 | 2.92 | 0.31 | 0.26 | 0.33 | 0.38 | 1.23 | 639 | 6.63 | 64.18 | 25.32 |
| JHO 851 | 12.16 | 1.90 | 32.84 | 2.94 | 0.31 | 0.27 | 0.33 | 0.41 | 1.06 | 521 | 5.94 | 62.66 | 19.40 |
| JHO 822 | 11.69 | 1.62 | 32.13 | 2.54 | 0.30 | 0.28 | 0.31 | 0.29 | 1.16 | 467 | 5.52 | 68.12 | 16.59 |
| RO 19 | 13.14 | 2.08 | 31.76 | 2.57 | 0.31 | 0.28 | 0.38 | 0.42 | 1.22 | 400 | 7.26 | 61.11 | 24.31 |
| JO1 | 11.99 | 1.88 | 31.68 | 3.58 | 0.27 | 0.28 | 0.30 | 0.35 | 1.11 | 559 | 6.07 | 67.30 | 20.61 |
| JHO 99-1 | 11.29 | 2.37 | 33.39 | 2.56 | 0.27 | 0.22 | 0.30 | 0.30 | 0.97 | 458 | 5.31 | 57.54 | 17.50 |
| JHO 99-2 | 11.54 | 2.09 | 33.35 | 3.41 | 0.34 | 0.24 | 0.35 | 0.32 | 1.18 | 502 | 6.24 | 63.29 | 20.31 |
| JHO 2004 | 13.01 | 1.80 | 31.76 | 3.68 | 0.33 | 0.27 | 0.34 | 0.35 | 1.26 | 597 | 6.41 | 65.01 | 21.02 |
| NDO 1 | 10.91 | 1.54 | 34.00 | 2.92 | 0.31 | 0.26 | 0.33 | 0.27 | 1.10 | 427 | 5.62 | 55.68 | 17.16 |
| OS 346 | 10.49 | 1.61 | 32.49 | 3.06 | 0.32 | 0.25 | 0.35 | 0.35 | 0.98 | 510 | 6.13 | 74.29 | 18.38 |
| HJ 8 | 10.62 | 1.84 | 31.94 | 3.02 | 0.31 | 0.25 | 0.35 | 0.33 | 1.09 | 455 | 6.07 | 65.77 | 22.20 |
| UPO 212 | 10.90 | 1.62 | 32.83 | 3.58 | 0.27 | 0.24 | 0.31 | 0.30 | 1.02 | 515 | 5.69 | 63.18 | 17.74 |
| KENT (NC) | 12.21 | 2.51 | 31.08 | 3.09 | 0.30 | 0.26 | 0.33 | 0.29 | 1.13 | 582 | 6.21 | 64.19 | 21.06 |
| Average | 11.72 | 1.92 | 32.50 | 3.07 | 0.30 | 0.26 | 0.33 | 0.33 | 1.11 | 510 | 6.08 | 64.02 | 20.12 |
| S. Em± | 0.83 | 0.26 | 0.77 | 0.26 | 0.02 | 0.01 | 0.02 | 0.02 | 0.09 | 61 | 0.38 | 3.32 | 1.91 |
| C. D. (P=0.05) | NS | NS | NS | 0.75 | NS | NS | 0.05 | NS | NS | NS | NS | NS | NS |

TABLE 4
Influence of different oat varieties on proximate parameters and mineral content in crop residue (Pooled).

| Treatment | Crude protein % | Crude fat % | Crude fibre % | Silica % | Ca % | P % | Mg % | S % | K % | Fe ppm | Cu ppm | Mn ppm | Zn ppm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JO-03-91 | 5.37 | 1.41 | 39.73 | 3.80 | 0.32 | 0.12 | 0.30 | 0.23 | 0.71 | 875 | 8.47 | 58.03 | 11.77 |
| JHO 851 | 5.98 | 1.73 | 37.63 | 3.75 | 0.33 | 0.11 | 0.30 | 0.26 | 0.83 | 697 | 6.84 | 51.00 | 11.53 |
| JHO 822 | 5.93 | 1.72 | 39.08 | 2.17 | 0.30 | 0.11 | 0.26 | 0.22 | 0.75 | 424 | 6.30 | 50.94 | 11.47 |
| RO 19 | 5.71 | 1.47 | 38.66 | 2.98 | 0.31 | 0.11 | 0.27 | 0.20 | 0.65 | 538 | 6.97 | 50.19 | 11.68 |
| JO1 | 5.36 | 2.14 | 38.64 | 3.07 | 0.33 | 0.15 | 0.29 | 0.23 | 0.83 | 527 | 6.79 | 60.74 | 13.00 |
| JHO 99-1 | 5.83 | 1.98 | 38.57 | 3.10 | 0.34 | 0.18 | 0.30 | 0.34 | 0.89 | 829 | 7.34 | 50.28 | 18.83 |
| JHO 99-2 | 5.64 | 1.57 | 38.49 | 4.01 | 0.33 | 0.11 | 0.29 | 0.34 | 0.69 | 867 | 8.31 | 58.58 | 11.62 |
| JHO 2004 | 5.16 | 1.58 | 38.91 | 2.62 | 0.30 | 0.09 | 0.28 | 0.26 | 0.67 | 721 | 6.71 | 47.83 | 11.70 |
| NDO 1 | 6.33 | 1.60 | 40.22 | 2.33 | 0.30 | 0.10 | 0.29 | 0.23 | 0.74 | 382 | 6.89 | 45.65 | 16.55 |
| OS 346 | 5.72 | 1.77 | 39.90 | 2.45 | 0.29 | 0.09 | 0.27 | 0.46 | 0.74 | 500 | 6.80 | 44.97 | 12.80 |
| HJ 8 | 5.69 | 1.61 | 40.06 | 2.43 | 0.30 | 0.11 | 0.29 | 0.27 | 0.78 | 434 | 7.26 | 46.90 | 11.90 |
| UPO 212 | 5.60 | 1.81 | 39.64 | 2.85 | 0.31 | 0.13 | 0.28 | 0.23 | 0.70 | 623 | 7.15 | 55.44 | 11.61 |
| KENT (NC) | 5.09 | 1.76 | 40.47 | 2.38 | 0.26 | 0.09 | 0.26 | 0.37 | 0.70 | 399 | 5.75 | 48.62 | 19.74 |
| Average | 5.64 | 1.73 | 39.23 | 2.92 | 0.31 | 0.11 | 0.28 | 0.28 | 0.74 | 601 | 7.04 | 51.47 | 13.40 |
| S. Em± | 0.56 | 0.18 | 0.95 | 0.45 | 0.02 | 0.02 | 0.02 | 0.07 | 0.11 | 151 | 0.57 | 4.72 | 3.02 |
| C. D. (P=0.05) | NS | 0.38 | NS | NS | NS | 0.04 | NS | NS | NS | NS | NS | NS | NS |

Potassium was non-significantly higher in JHO 2004 (1.26%) while lowest amount was recorded in JHO 99-1 (0.97%). Highest quantity of copper was observed in RO 19 (7.26 ppm) while it was at par with other varieties and lowest in JHO 99-1 (5.31 ppm). Oat variety JO-03-91 recorded higher iron (Fe) and zinc (Zn) content, whereas, manganese content (Mn) was observed highest in oat variety OS 346 (Table 3).

### Proximate Parameters and Mineral Content in Crop Residue

Proximate parameters and mineral content in crop residue (CR) of different oat varieties were also analysed but pooled analysis of two years data showed significant differences among oat varieties for crude fat and phosphorus content only (Table 4). Among oat varieties, JO 1 variety (2.14%) at par with UPO 212, JHO 99-1, OS 346 and Kent recorded significantly higher crude fat content than remaining oat varieties. Among oat varieties, mean crude protein, crude fat, crude fibre and silica content varied between (5.09-6.33 %), (1.41-2.14 %), (37.63-40.47 %) and (2.17-3.80 %), respectively. Except phosphorus, non-significant differences existed among oat varieties for mineral content (Table 4). Oat variety JHO 99-1 (0.18 %) at par with JO 1 (0.15 %) recorded significantly higher phosphorus content than remaining oat varieties. However, mineral contents for calcium, phosphorus, magnesium, sulphur and potassium were recorded between (0.26-0.34 %), (0.09-0.18 %), (0.26-0.30 %), (0.20-0.46 %), (0.67-0.89 %), respectively in oat varieties crop residue at harvest. Iron, copper, manganese and zinc content in oat varieties crop residue ranged between (382-875 ppm), (5.75-8.47 ppm), (44.97-60.75 ppm) and (11.47-19.74 ppm), respectively.

## CONCLUSION

Based on the findings of the present investigation, it may be concluded that the oat variety UPO 212 proved superior variety with respect to getting higher green fodder and dry matter yield under central Gujarat conditions. However economic analysis and Benefit: Cost ratio proved that for taking green fodder production, oat varieties UPO 212 and OS 346 may be the best option under central Gujarat conditions. In seed production, National Check (NC) variety Kent was found most suitable in terms of seed productivity and Benefit: Cost ratio; closely followed by another promising oat variety NDO 1. Hence these two varieties may be recommended for getting higher returns from oat seed production under central Gujarat conditions.

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