SUMMARY AND CONCLUSIONS

EFFECT OF DIFFERENT LEVELS OF NITROGEN AND METHODS OF APPLICATION OF UREA ON THE YIELD AND NUTRITIVE VALUE OF GREEN JOWAR (Sorghum vulgare) and Silage
SUMMARY AND CONCLUSIONS

The present investigation entitled "Effect of different levels of nitrogen and methods of application of urea on the yield and nutritive value of green Jowar (Sorghum vulgare) and silage" was undertaken to throw light on varietal evaluation, responses to graded doses of nitrogen, efficient methods of nitrogen fertilization for increased yield of nutritious fodder. Variables involved in these studies were three sorghum varieties (JS 263, Ujjain 8 and Vidisha 60-1); three levels of nitrogen (30, 60 and 90 kg N/ha); and three methods of urea application (Soil, Soil + Spray and Spray). Thus there were 27 treatment combinations which were tested in $3^3$ factorial in Randomised Block Design with two replications. The investigations were taken up in three phases: production (field trial); evaluation (chemical composition) and nutritive value estimation (metabolic trial) of green chop sorghum and silage. Following are the salient features of the results obtained:

I. Production

A field trial was conducted in which three sorghum cultivars were grown using three levels and methods of nitrogen application during the Kharif (Monsoon) 1971.

1. Variety Vidisha 60-1 with a production potential of 10.19 q/ha outyielded the remaining strains Ujjain 8 and JS 263 in green forage yield. The graded doses of nitrogen increased
the forage yield with the result that 90 kg N/ha produced the maximum yield (338.44 q/ha) but did not differ significantly from 60 kg N/ha. Nitrogen, half through soil and half through foliage yielded 335.90 q/ha which was 9.58 and 16.37 q/ha more over full soil or full foliar application, respectively, but this also did not reach the level of significance.

2. Although Ujjain 8 exhibited the maximum DM content (34.33%) but the highest production of 111.25 q/ha was found with Vidisha 60-1. The increasing doses of nitrogen brought about only slight variation in DM production with practically no change in dry matter content. The marginal gain obtained with soil + foliar method over soil or foliar alone followed the pattern of green matter production.

3. Vidsiha 60-1 and Ujjain 8 accumulated similar dry matter of about 101.00 kg/ha/day and was significantly superior to JS 263. Additional doses of nitrogen added only marginally, to DM production per unit area and per unit time. The production (unit area/day) in relation to methods of nitrogen application followed the pattern of total green and dry matter yield and went in favour of soil + spray method.

4. Plant height, number of leaves and length of the longest leaf were greater in Ujjain 8 but the breadth of the longest leaf was more in Vidisha 60-1. Moreover narrower leaf
stem ratio was observed in the case of Vidisha 60-1 compared to Ujjain 8. No significant variation in various yield attributes were observed due to different levels of nitrogen application, except the breadth of the longest leaf which was significantly greater with 90 kg N/ha. The different methods of nitrogen application did not affect the growth characters but in general soil + spray application found to be superior for producing taller and thicker plants with more number of leaves.

5. Though the total forage yield increased with successive increase in nitrogen level, no economic return could be realized beyond 30 kg N/ha.

II. Evaluation

The green Jowar samples and the silage prepared from all the 27 treatments were evaluated for chemical composition and biochemical parameters.

1. Cultivar Vidisha 60-1 showed the highest dry matter digestibility (47.34%) and resulted in maximum digestible dry matter production per hectare. The increasing levels of nitrogen from 30 to 90 kg N/ha and its methods of application had no significant effect on dry matter digestibility and digestible dry matter production.

2. Cultivar JS 263 showed significantly higher crude protein content (8.83%) than Ujjain 8 (7.52%) and Vidisha 60-1
but the maximum crude protein yield (8.37 q/ha) was observed in the case of Vidisha 60-1. The crude protein content and production progressively increased with successive doses of nitrogen but the differences were marginal and not significant. There was no significant variation in crude protein content or production due to various methods of nitrogen applications. The sorghum strains showed differential behaviour at various nitrogen levels with respect to crude protein content, but for production the levels and methods of nitrogen application interacted significantly (P < 0.01).

3. There was significant variation in the ADF content between JS 263 (27.43%) and Vidisha 60-1 (30.20%) but both exhibited significantly lower per cent than the Ujjain 8 (33.31%). The ADF production with Vidisha 60-1 and Ujjain 8 were at par but significantly higher (P < 0.01) than JS 263. The different levels and methods of nitrogen application did not influence significantly the ADF per cent and production. At 30 kg N, soil + spray; at 60 kg N, spray alone gave lower ADF content but at 90 kg N the differences due to the three methods of nitrogen application did not reach the level of significance.

4. The lowest lignin content was found with Vidisha 60-1 and highest with Ujjain 8. The JS 263 occupied the intermediate position. Among the methods of nitrogen application, soil + spray and spray application showed significantly lower (P < 0.01)
lignin content than soil application indicating that soil applied nitrogen caused greater lignification in the plant. The levels of nitrogen had no significant effect on the lignin content. The production levels followed the same trend as the lignin content with the three factors under study.

5. Ujjain 8 recorded significantly higher ($P < 0.01$) cellulose per cent (36.44) and production (39.63 q/ha) over JS 263 and Vidisha 60-1. Different levels and methods of application of nitrogen did not significantly influence either the cellulose content or production per hectare.

6. Ujjain 8 proved to be significantly ($P < 0.01$) superior to Vidisha 60-1 and JS 263 in digestible cellulose percentage and production. The differences in digestible cellulose content as well as yield were within the normal range of variation and no significant difference was observed either due to nitrogen levels or their methods of application.

7. The different treatments did not influence significantly either the ether extract or ash content of the sorghum fodder.

8. Ujjain 8 and Vidisha 60-1 produced similar level of gross energy (GE)/ha and were significantly ($P < 0.01$) superior to JS 263. The availability of gross energy/ha increased with increasing doses of nitrogen but the differences were within the normal range of variation. Half soil + half foliar application of nitrogen was at par with soil application but
significantly superior to foliar application in GE production/ha. However, interaction between nitrogen level into methods of application was also found to be significant (P < 0.05).

9. All the silage samples from three cultivars with different levels and methods of nitrogen application showed the ideal pH range (4.13 to 4.39). However, the pH value of the silage prepared from Ujjain 8 was significantly higher (P < 0.05) than those of Vidisha 60-1 and JS 263. Nitrogen application with different doses and methods of application did not significantly influenced the pH value of silage.

10. Silage prepared out of Ujjain 8 showed significantly higher (P < 0.01) DM of 34.10 per cent as compared to 30.84 and 28.86 per cent by JS 263 and Vidisha 60-1, respectively.

11. The highest lactic acid content of 12.87 per cent was observed in the silage of Vidisha 60-1. A significant decrease in lactic acid content from as high as 13.38 to as low as 7.87 per cent was observed with increasing doses of nitrogen from 30 to 90 kg N/ha. Soil + spray application of nitrogen produced the maximum lactic acid content but did not differ significantly either from soil or foliar alone. However, variety into nitrogen interaction was found to be significant (P < 0.05).

12. Silage of Vidisha 60-1 showed the significantly higher acetic acid content of 3.88 per cent as compared to 3.31 and 2.77 per cent by Ujjain 8 and JS 263, respectively. Nitrogen
application at 30 and 60 kg/ha resulted in similar acetic acid per cent in silage. However, further increase of nitrogen level to 90 kg/ha, significantly (P \leq 0.01) reduced the acetic acid content. Application of nitrogen through foliar or soil + foliar were at par between themselves but significantly (P \leq 0.01) superior to soil application. It was also noted that interactions between various treatment were also significant.

13. Vidisha 60-1 showed the lowest butyric acid (0.15%) as compared to Ujjain 8 (0.38%) and JS 263 (0.92%), respectively. Increasing levels of nitrogen significantly (P \leq 0.01) increased the butyric acid content. Whereas, soil + spray and spray application of nitrogen showed significantly (P \leq 0.01) lower butyric acid as compared to soil application. The interaction between variety into nitrogen and nitrogen into method were found to be significant (P \leq 0.01).

14. Silage of JS 263 exhibited significantly (P \leq 0.05) more crude protein per cent as compared to Ujjain 8 and Vidisha 60-1. The CP content of silage remained unaffected by various doses of nitrogen and their methods of application.

15. Ujjain 8 silage showed a significantly (P \leq 0.05) lower value (8.35%) of ammoniacal N as per cent of the total nitrogen, when compared to silage prepared from JS 263 (10.55%)
and Vidisha 60-1 (10.1%). Ammoniacal nitrogen content increased with increasing doses of nitrogen but did not reach the level of significance. The different methods of nitrogen application also did not bring out any significant differences in ammoniacal nitrogen of the silage.

III. Nutritive value estimation

On the basis of the results obtained in first and second phase of the investigation, Vidisha 60-1 variety of sorghum was selected on account of best performance at 60 kg N with soil + spray method of application and was grown on large scale in the Kharif (Monsoon) 1972. The comparative investigations were made to study the nutritive value of green fodder and silage from it by conducting feeding cum metabolic trial on dairy cattle.

1. Organic matter, crude protein, ether extract and nitrogen free extract content (91.30, 7.52, 1.23 and 49.11%) were higher in green fodder as compared to the respective values (87.83, 7.24, 1.10 and 45.34%) in silage. Whereas, the content of acid detergent fibre and ash was more in silage. The Vidisha 60-1 variety of Jowar grown under the above management conditions gave a protein content of 7.52 per cent.

2. The intake of dry matter, organic matter, acid detergent fibre, crude protein, ether extract and nitrogen free extract from green fodder were significantly (P < 0.01) higher
than from the silage. It was observed that due to ensiling there was a significant reduction in the intake of the nutrients of the forage. The DM to water intake ratio was statistically narrower with green fodder as compared to silage.

3. The digestibility of dry matter (56.51 ± 1.16 and 58.11 ± 1.72) and organic matter (60.53 ± 0.94 and 60.97 ± 1.03) from the green and silage were evidently within the normal range of variation. The digestibility of crude protein, ether extract and nitrogen free extract of green fodder were found to be (55.35 ± 0.91; 69.57 ± 1.77 and 65.57 ± 1.88 percent, respectively) significantly (P < 0.01) higher than the digestibility of these nutrients (44.14 ± 1.20; 54.66 ± 3.47 and 50.38 ± 1.70, respectively) from the silage. However, digestibility of ADF in silage was significantly higher (69.42 ± 1.96) as compared to green fodder (51.19 ± 0.98).

4. The DCP obtained from the silage (3.22 ± 0.08) was significantly (P < 0.01) lower than the fresh material (4.17 ± 0.07). The TDN content for green and silage were 55.41 ± 0.80 and 55.19 ± 1.50 per cent, respectively. Gross energy (GE) content of green jowar (5.95 Mcal/kg) was on the higher side as compared to 5.32 Mcal/kg of the silage. The digestible energy (DE) in green (3.66 ± 0.11) was higher than the silage (3.21 ± 0.10) but the variations were within the normal range. The metabolizable energy (ME) was significantly higher (P < 0.01) in green fodder (2.98 ± 0.12 Mcal/kg) as compared to 2.16 ± 0.18 Mcal/kg in silage.
The NVI of fresh green jowar was found to be significantly higher ($P < 0.01$) being 61.63 compared to 36.19 with its conserved form as silage.

5. It has been found that green jowar feeding was able to meet the DCP requirement for maintenance of dry cows as per mid Morrison (1969) standard, whereas, the silage could not meet the same. The TDN derived from the green was 41.65 per cent more than the expected mid Morrison Standard, whereas, from the silage it was 12.75 per cent less. The conservation of green fodder as silage, adversely affected the DCP and TDN availability from the forage. Thus it was evident that the feeding of green jowar (CV.Vidisha 60-1) was able to meet the DCP and TDN requirements as per mid Morrison value, whereas, feeding of jowar silage would necessitate the supplements with green fodder or concentrate mixture to meet the DCP and TDN requirements of the cattle.

CONCLUSIONS

Following conclusions could be drawn on the basis of results of the present investigations.

1. Variety Vidisha 60-1 fertilized with 60 kg N/ha by soil and spray method exhibited the higher yield potential both for green and dry matter production per hectare which was further supported by greater leaf breadth with narrow stem leaf ratio, an important index of forage palatability.
2. Higher dry matter digestibility, crude protein production, medium levels of acid detergent fibre (ADF) and gross energy (GE) and lowest lignin content were recorded in Vidisha 60-1. The chemical constituents either marginally increased or remained unaltered with three levels and methods of nitrogen fertilization. However, low lignin content was found with soil + spray method.

3. Silage of Vidisha 60-1 with ideal pH value exhibited the highest content of lactic acid and acetic acid on one hand and low butyric acid on the other. Both lactic and acetic acids decreased with increasing nitrogen levels, whereas, reverse trend was observed with respect to ammoniacal nitrogen. Soil + spray applied nitrogen proved better for silage quality.

4. Feeding green fodder of Vidisha 60-1 to dairy cattle was able to meet the requirement for maintenance in terms of digestible crude protein as well as energy. Feeding of silage alone, however, could not meet the DCP and energy requirements of dry cows.

Thus, variety Vidisha 60-1 fertilized with 60 kg N/ha by half soil + half spray method could safely be recommended for cultivation under North Indian conditions to exploit its full production potential for high, nutritious and palatable fodder, as well as better quality silage.

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