

## AGRONOMY OF FORAGE SORGHUM UNDER HIGH AND LOW INPUT CONDITIONS—A REVIEW

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### ABSTRACT

The work on forage sorghum remained neglected and little information is available on agronomy of this crop. Differential responses to nitrogen have been obtained depending upon soil, climate and irrigation. The responses to 24-50 kg N/ha under dryland conditions, 60-90 kg N/ha under irrigated conditions and 150-190 kg N/ha at Pantnagar and Jabalpur have been noted. The crop did not respond to phosphorus application. Application of 0.25 kg atrazine ai/ha proved effective. It is felt that there is need to workout complete agronomy on this crop particularly under variable crop sequences. However, some efforts have been made in this direction at NDRI, Karnal and HAU, Hissar.

Among rainy season crops in Northern India, jowar (*Sorghum bicolor* (L.) MOENCH) is the most important forage crop. It does fairly well under wide range of soil types. The crop is preferred over pearl millet and maize in rainy season because of its wide tolerance to drought and water-logged conditions.

**Seeding time and depth :** Rainfed sorghum sown 10 and especially 20 days before the onset of monsoon rains, gave appreciably higher dry matter yield than when sown with the onset of monsoon. Yields were higher with a sowing depth of 5.0 cm than with a depth of 2.5 or 7.5 cm (Periyathambi and Palaniappan, 1981).

**Nitrogen application need :** An improvement in yield of fodder jowar with 50 kg N/ha was reported by Verma (1952). The increase in yield of jowar as high as 67% above control was noted by Vijaya and Yawalkar (1966) with an application of 90 kg N/ha. In nitrogen deficient soils, Tomer and Singh (1969) found increase in sorghum yields in pure as well as mixed stands upto an application of 67.2 kg N/ha. Further, Tomer *et al.* (1970) reported 67.2 kg N/ha as the best dose for maximum starch equivalent production by this crop. Gill *et al.* (1972) reported increase in dry matter production of jowar by 75 kg N/ha. The response of jowar to applied nitrogen was found only upto 24 kg N/ha at Jodhpur which resulted in by Singh *et al.* (1971a). Further they reported (Singh *et al.*, 1971 b) 53.7 kg nitrogen as optimum for variety 'Sojan Barn' a highly palatable variety for Jodhpur conditions. Under Jabalpur conditions, Bagga (1972) found response of jowar upto 180 kg N/ha. The improvement was in the order of 178 quintals of green equivalent of 47 quintals dry matter/ha over control. At Hissar (Anonymous, 1973) 60 to 200 kg N levels were at par with regard to jowar yield while at Karnal, Singh (1975) observed higher yield of jowar with 60 kg N/ha. Thangamuthu and Sundaram (1974) reported that application of 75 kg N/ha resulted in maximum green and dry matter yield of jowar. Differential response of jowar to nitrogen was noted at different places (Paroda, 1975 and Anonymous, 1975) The response was observed upto 150 kg N/ha at majority of places except at Hissar and Coimbatore where

it was only upto 75 kg N/ha. Varieties 'Pusa chari 1', at Hissar and 'Pusa chari 2' and 'Rio' at Pantnagar responded upto 150 kg N/ha. The response of *jowar* to applied nitrogen was upto 120 kg N/ha as reported by Desai and Deora (1980).

An improvement in crude protein in *jowar* with the application of 50 kg N/ha was reported by Verma (1952). Similar increase was observed by Gill *et al.* (1973) with 100 kg N/ha. On the other hand, Tomer *et al.* (1970) reported higher production of crude protein, crude fibre, crude fat, NFE and SE with 67.2 kg N/ha. Similarly, Lingam (1981) working at Karnal reported that the production of metabolizable energy, crude protein, crude fat, NFE, total mineral matter, calcium magnesium, phosphorus and potassium in *jowar* were improved with 90 kg N/ha. Calcium phosphorus ratio and K/ (Ca+Mg) ratio remained unaltered. The higher nitrogen application (150 kg N/ha) reduced the protein as well as phosphorus content and increased ash content of fodder *jowar* as compared to 75 kg N/ha (Thangamuthu and Sundaram, 1974).

**Nitrogen application need in relation to preceding crops:** Kanwar Singh and Gill (1976) working on nitrogen application requirements of *jowar* in relation to preceding winter crops, reported that when *jowar* was taken after berseem, *metha*, fallow and *senji*, the economic doses of nitrogen were 85.6, 96.4, 101.6 and 112.0 kg N/ha, respectively. Likewise, Lingam (1981) while working at Karnal, found that economic optimum doses for *jowar* preceded by green gram, cowpea, fallow, maize and pearl millet as summer crops were 46.3, 59.4, 63.0, 64.0 and 78.7 kg N/ha.

**Phosphorus application requirements:** Like nitrogen, phosphorus plays an important role as a structural component of cell constituents and metabolically active compounds. It is a structural component of membrane system of cell, chloroplasts and mitochondria. It increases root growth and ultimately the feeding zone. Thus, availability of nutrients helps in building up of plant tissues resulting in better growth.

Gill *et al.* (1972) reported no response of phosphorus application of fodder *jowar* on both red as well as black soils. Similarly, Tomer *et al.* (1970) did not find any increase in yield of fodder *jowar* (0 to 67.2 kg P<sub>2</sub>O<sub>5</sub>/ha). Rathore and Vijay Kumar (1977 a) also could not find response to the application of 35 kg P/ha in this crop. Similarly Lingam (1981) indicated that application of phosphorus failed to bring any improvement in the production of fresh and dry matter, metabolizable energy, crude fat, NFE, total mineral matter, calcium, potassium and magnesium. Calcium phosphorus ratio and K/ (Ca+Mg) ratio also did not undergo any change.

**Bacterial fertilization:** Use of *Azospirillum brasilense* in *jowar* increased green forage yield markedly over control and 30 kg N/ha. Further it was observed

that when seed was treated with *Azospirillum brasilense* and crop was fertilized with 30 kg N/ha, yield was appreciably increased over their separate applications (Sahab Singh *et al.*, 1980).

**Weed control:** Application of atrazine 0.25, 0.5 and 0.75 kg ai/ha at pre-emergence or 10 days after the germination of *Trianthema monogyana* proved at par with regard to forage production. Further it was observed that post emergence application of the chemical done after 10 days of weed emergence was appreciably better than applied after 20 days. However, at 1.0 kg rate of atrazine as pre-emergence, phytotoxic effect on *jowar* was noted (Tomer and Harika, 1981, Anonymous, 1974-75) but this phytotoxic effect of higher doses of atrazine was eliminated when 10-40 ton of FYM/ha was applied to *jowar* (Chopra, 1982). No residual effect of atrazine upto 1.0 kg ai/ha applied to *jowar* was observed on germination, growth and yield of succeeding crops of mustard and turnip.

**Irrigation:** Fresh and dry fodder yields were reduced by with holding irrigations during any one or more stages of growth i.e. establishment, vegetative lag and flowering stage. Vegetative lag was the most critical in its demand for assured water supply. For maximum forage production, *jowar* needed the maintenance of 60% ASM in 60 cm soil depth (Hakkeri and Shukla 1983).

**Mixtures:** Studies on *jowar*+*guar* mixture showed that crop of pure *jowar* or with higher proportion of *jowar* in the mixture performed better than that of lower proportion or pure *guar* with regard to forage and energy production (Tomer and Singh, 1968, Tomer *et al.* 1970).

**Input management:** Studies made at Ranchi indicated that recommended fertilizers (80 kg N + 30 kg P<sub>2</sub>O<sub>5</sub>/ha) coupled with line sowing and one hand weeding gave 30.2, 77.8, 112.7, 156.1 and 179.4 quintal additional fresh forage yield over recommended fertilizers alongwith line sowing and 0.5 kg atrazine, recommended fertilizers alongwith line sowing and no weed control, lower dose of nitrogen (25 kg N/ha) alongwith line sowing and no weeding, lower dose of nitrogen alongwith broadcasting and no weeding and no fertilization alongwith broadcasting and no weeding (Anonymous, 1980-81).

**Rotation:** The productions of fresh as well as dry matter, metabolizable energy, crude protein, crude fat, NFE, total minerals, phosphorus and potassium were higher with *jowar* preceded by legumes (Green gram and cowpea) as compared to cereals (maize and pearl millet) as reported by Lingam (1981).

**Economics:** *Jowar* preceded by green gram, fallow or cowpea and fertilized with 90 kg N/ha gave much higher net return than other treatment combinations. When system as a whole was taken into account, *jowar*, grown after green gram and fertilized with 90 kg N/ha resulted in maximum net return per hectare (Rs. 5652.50). The lowest income (Rs. 671.00), however, was obtained when *jowar* was preceded by fallow and fertilized with 135 kg N and 45 kg P<sub>2</sub>O<sub>5</sub>/ha (Lingam, 1981.)

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