Linking producers and processors–sorghum for poultry feed: A case study from India

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Introduction

Global production of sorghum [*Sorghum bicolor* (L.) Moench] is currently estimated at 57.6 million tons, with Asian countries contributing 20% of this total [FAOSTAT 2002–04 (ave.)]. Within Asia, India is the largest producer of sorghum, producing 7.3 million t. Sorghum in India is grown in the rainy-season (June-October) and in the postrainy season (September-January). Rainy-season sorghum accounts for about 60% of total sorghum production (CMIE 2004). Resource-poor, small-scale producers in the semi-arid tropics (SAT) with less than one-hectare land grow sorghum, to meet household requirements of food and fodder. Thus, sorghum is an important food security crop in a wide range of marginal areas in India. The importance of the crop is enhanced due to its stover, which is an important source of dry fodder for draft and dairy animals (Kelley et al. 1993, Kelley and Parthasarathy Rao 1994, Hall and Yoganand 2000).

However, during the last two decades, several factors are contributing to a change in the traditional role of sorghum as food security crop. On the supply side, sorghum area and production have been declining in India and in Asia as a whole. For example, in India, between 1980 and 2004 sorghum area declined by 2.8% and production by 2%. Low market price, lack of effective Minimum Support Price (MSP) and high tariffs on imports of edible oil (jacking up the domestic price of oilseeds) has led to substitution of sorghum with oilseeds. On the demand side, with rising incomes, urbanization and subsequent changes in consumer tastes and preferences, market demand for food uses of sorghum has declined. This is further compounded by the public distribution system (PDS) of rice and wheat at subsidized prices for low-income consumers.

But utilization patterns of rainy-season sorghum are in a dynamic phase. Besides its traditional use as food crop, it is finding niches in alternative uses such as livestock and poultry feed, potable alcohol, starch and ethanol production (Kleih et al. 2000). Of these, the fastest growing sector is the poultry feed sector. For example, poultry production in India is expected to grow at 15% to 20% per annum for broilers and 10% to 15% for layers, leading to a corresponding expansion in demand for feed (Dayakar Rao et al. 2003). Maize (*Zea mays* L) is the main cereal feed ingredient, which constitutes 30−35% of poultry rations. Presently, maize production is growing only at 3−4% per annum leaving a gap to be filled by alternative sources. Preliminary studies have shown that under tropical conditions, sorghum can replace up to 60% of maize in broiler diets and 50−100% of maize in layer chickens without any adverse effects on the performance (Ramasubba Reddy and Nageswara Rao 2000). But, lack of availability of rainy-season sorghum in bulk quantities and assured supplies throughout the year is one of the main reasons constraining its usage in the industry. Although about 35% of marketable surplus is available, these are often scattered and hence non-economical to procure in sufficient bulk quantities by industrial users (Marsland and Parthasarathy Rao 1999).

Existing market system for sorghum grain

Sorghum is sold through regulated and non-regulated channels. Regulated markets are those in which business is done in accordance with the rules and regulations framed by the statutory market organization, the Market Committee. There are a number of possible ways for the farmer to dispose off sorghum grain off-farm (Fig. 37).

Use and sale by farmers: After harvest, sorghum grain may be retained on-farm, to be used for home consumption or as seed or for payment in kind. The surplus grain is sold either in a regulated market through Commission Agents in the markets or through a broker (middleman) at the village. Despite several inefficiencies and exploitation by middlemen, Marshland and Parthasarathy Rao (1999) found that the marketing system per se does not constrain the utilization of the crop as food grain. At the same time, the study concluded that the existing marketing system may not be optimal for industrial users, and they would prefer to obtain sorghum through new institutional arrangements such as contract farming, bulk purchasing, etc, that compress the marketing chain and thus reduce transaction costs.

In short, the rationale for the new marketing arrangement include the following:

- Potential demand for sorghum grain in poultry feed and other emerging alternative uses
- Non-availability of grain in bulk quantities due to scattered and variable surplus production over subsistence needs
- Need for assured supply of quality grains in bulk quantities.

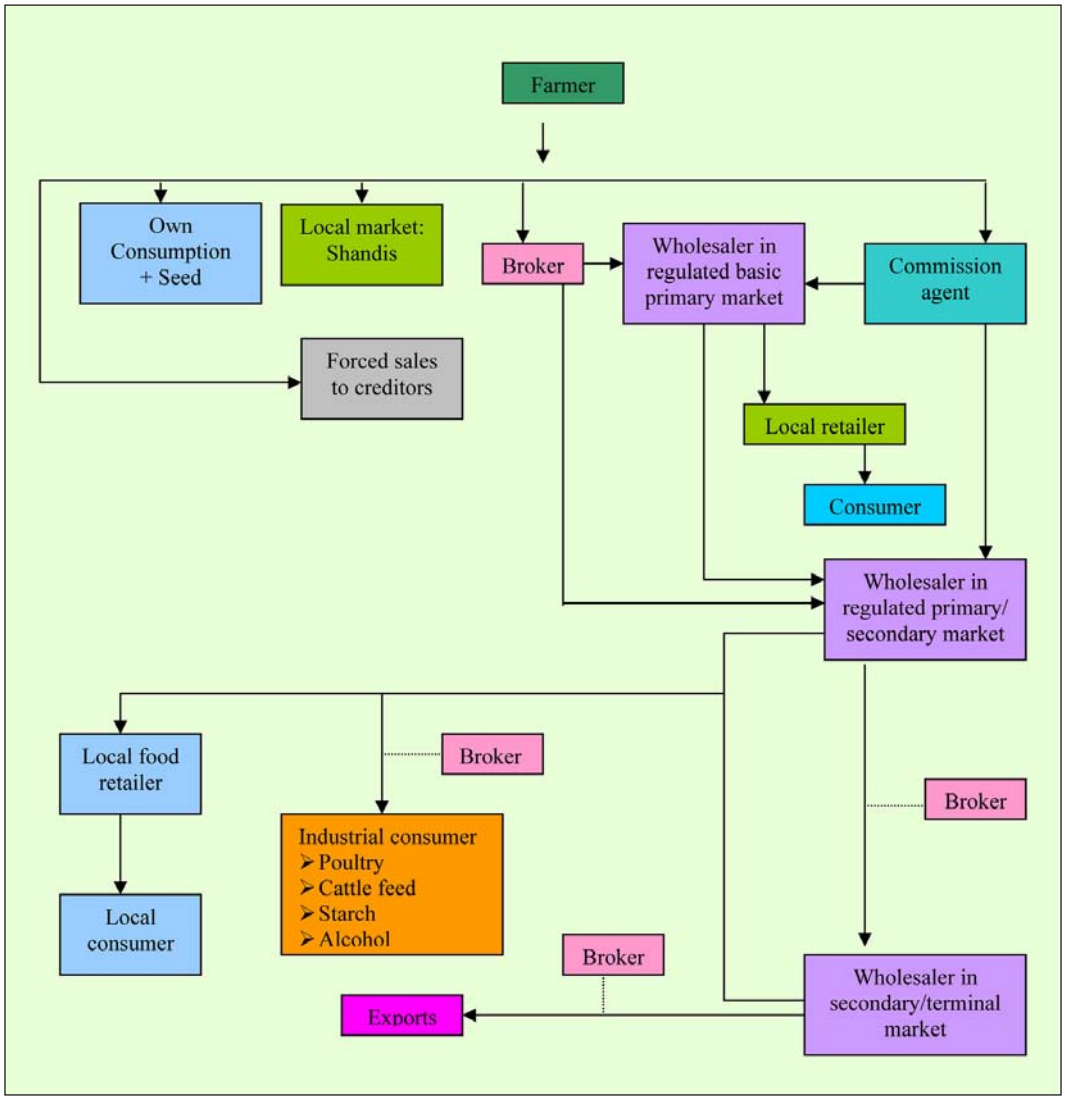


Fig. 37. Flow chart of traditional marketing chain for sorghum grain in India.

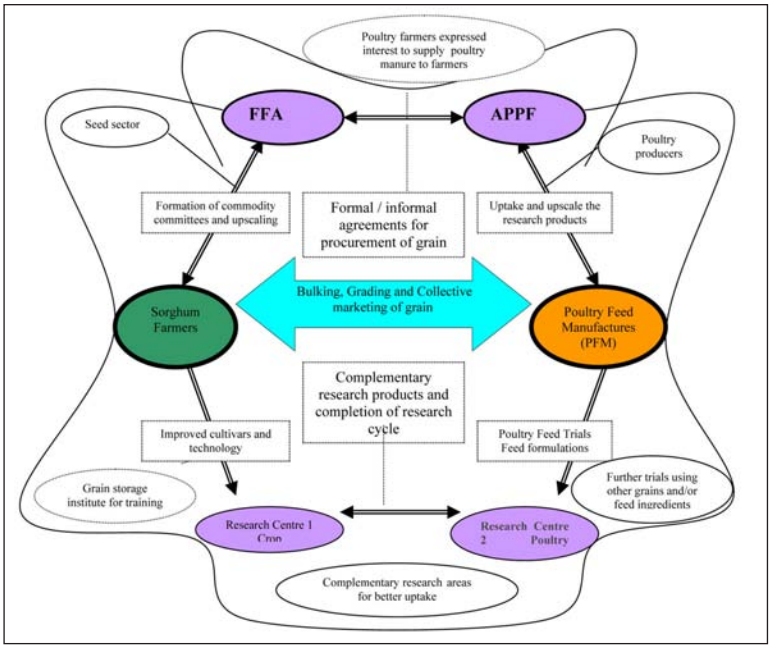
In this context, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India, along with Acharya NG Ranga Agricultural University (ANGRAU), Hyderabad, India, has implemented a project funded by DFID (Department for International Development, UK) in collaboration with non-governmental organizations—Federation of Farmers Associations (FFA) and Andhra Pradesh Poultry Federation (APPF), and Janaki Feeds, a private poultry feed manufacturer, aimed at establishing market linkages between sorghum growers and poultry feed manufacturers. Under this project, farmers were supplied with seed of improved sorghum cultivars and trained in bulking and storage of

grain; poultry nutritionists conducted broiler and layer feed trials with sorghum-based feed rations; and feed manufacturers developed poultry feed rations with sorghum replacing maize in varying proportions. The common underlying goal of all the coalition partners was creation of marketing opportunities for small-scale sorghum growers by creating a sustainable economic inter-linkage between them and the poultry feed industry (Fig. 38).

Defined roles of coalition partners

Each partner/stakeholder had his or her own reasons for joining the coalition. The ICRISAT plant breeders and ANGRAU poultry scientists were interested in forming links with farmers and feed manufacturers to improve the uptake of their research outputs and findings. The sorghum farmers, represented by the FFA, saw the potential to increase the security of their livelihoods. Janaki Feeds saw the business potential of the new knowledge generated by the project and the opportunities for more reliable grain supplies. The APPF saw the potential benefits to its members by way of alternative feed ingredients and sources.

> A unique feature of this approach is the 'coalition' ie, the process in which distinct/independent entities/institutions work together as a single unit, while keeping their identity, for the common goal with synergistic effect.



FFA – Federation of Farmers Association, APPF – Andhra Pradesh Poultry Federation

Fig. 38. A coalition approach for promoting sorghum for poultry feed.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT): Selection of suitable sorghum cultivars, multiplication and distribution of seed to participating farmers, grading and bulking of produce, networking of partners, project implementation and monitoring, and assessing impacts of the project.

Acharya NG Ranga Agricultural University (ANGRAU): Conducting poultry feed trials with sorghum as principal cereal ingredient, providing technical guidance on consumption and quality of sorghum in poultry feeds.

Federation of Farmers Associations (FFA): Represent the interest of the farmers. Identify suitable sorghum growing areas and farmers; disseminate the information on improved technology to the farmers, formation of Farmers Association and foster effective linkages with end users.

Andhra Pradesh Poultry Federation (APPF): Represent the interest of poultry producers. Take lead to interact with poultry producers; upscale use of sorghum in poultry feed rations.

Janaki Feeds**:** Represent the interests of feed manufacturers. Prepare feed formulations using different proportions of sorghum and up-scale project findings after completion of project.

At a later stage, a private seed company also joined the coalition for dissemination of seed of improved varieties of sorghum. The extended shoulders in Figure 38 represent further scope in enhancing partnerships between and among coalition partners. For example, poultry farmers expressed interest in supplying poultry manure to the farmers and in turn procure surplus grain. The boxes in white indicate probable areas of collaboration in the near future.

Linking farmers and poultry feed manufacturers

In the process of linking sorghum producers and poultry feed manufacturers, many simultaneous activities were carried out. For instance, Poultry Feed Trials (PFT) to further corroborate the efficiency of sorghum in poultry rations, supply of improved sorghum seed and technology to farmers, formation of farmers' groups, etc. These are briefly discussed below.

Farm trials for increased productivity

In Andhra Pradesh, rainy-season sorghum is grown on 0.30 million ha, producing 0.29 million tons of grain while the postrainy season sorghum accounts for 0.34 million ha producing 0.35 million t of grain (GOAP 2003). The Mahabubnagar and Ranga Reddy districts of Andhra Pradesh, India, where rainy-season sorghum

cultivation is predominant, were selected for the implementation of project activities at the field level. For the 2003 and 2004 rainy-season sowings, seed of four improved high yielding sorghum cultivars, namely CSH 16, CSV 15, PSV 16 and S 35, suitable for that agro-climatic area and known to be less susceptible to grain mold attack were supplied to the chosen farmers in selected villages. The farmers fields were regularly monitored for sowing, germination, timely fertilizer application, inter cultivation, weeding and harvesting. During the meetings/field visits, ICRISAT scientists illustrated the proper harvesting stage of the crop to avoid grain mold incidence that reduces the market price of the grain. The participating farmers' realized three to four fold increase in yields by adopting improved technology (improved cultivars and practices) with proportionate increase in net farm income (Parthasarathy Rao et al. 2004).

Poultry feed trials

The use of sorghum in poultry feed is not new and its usage is quite common despite several apprehensions related to its use in place of maize (tannins, toxins, yolk color, etc). The general consensus was that sorghum can replace maize partially or fully provided its price was Rs 0.50 to 0.75/kg lower than the price of maize (US$1 = Rs 40). To dispel some of the apprehensions on use of sorghum in poultry rations, poultry feed trials (PFTs) using sorghum were carried out by ANGRAU. The tests on both layers and broilers showed that sorghum could replace maize since all parameters like, weight gain, feed consumption and feed efficiency were comparable with those for maize (Laxmi Tulasi et al. 2004 and Rajasekher Reddy et al. 2005).

The poultry nutritionists carried out the broiler feed trials by making all the diets iso-nitrogenous, iso-caloric and homogenous in lysine, methionine and cystine levels. A second trial on part-by-part replacement of maize with sorghum was carried out at the insistence of the feed industry. The findings were not very different (except the light color of the skin of the broilers, which was recovered partially with addition of s*tylosanthes* leaf meal to the diets) and it is this trial that helped in buy-in of the results by the industry. In the case of layers too, the experiments were conducted twice. Initially the trials were conducted on White Leghorn (WLH) breed but subsequently Bobcock (*commercial layer birds*) was included upon the insistence of poultry producers. It is probable that if the feed trials had been carried out in isolation, the poultry producers and feed manufacturers would have less confidence in the results.

Simultaneously, the poultry feed manufacturers prepared poultry feed rations based on varying proportions of sorghum for testing and sale. For all the above trials and their variants, information was disseminated through workshops and leaflets.

Establishing market linkages

The ultimate goal of the project was to link small-scale sorghum producers with poultry feed manufacturers through informal institutional arrangements. The process included the following steps:

a) Formation of Farmers' Association: Farmers Association constituted in each project village consisting of farmers participating in the project.
b) Training on specific skills: Farmers' group trained on grading the sorghum grain as per grain mold severity, bulking the surplus and storing according to scientific principles.
c) Collective Sale: The surplus sorghum grain stored collectively by the farmers was sold to poultry feed manufacturers after careful negotiations between Farmers' Association representatives and feed manufacturers at a mutually agreeable price.

Advantages of bulk marketing

Farmers

- Better price realization
- Increase in bargaining capacity of the farmers
- Minimizes middlemen charges/transaction cost
- Increases the involvement of the farmers and makes them independent
- Improves market intelligence
- Market expansion.

Buyer

- Overcoming multiple transactions
- Assured supply of produce
- Overcoming seasonality in purchase to some extent (grain availability throughout the year)
- Quality of the produce guaranteed
- Origin ensured (from particular locality with specified qualities).

Innovation

For all stakeholders, this was their first experience of such a broad-based coalition involving different types of organizations (public, NGO, private), with different skills and expertise (breeding, poultry nutrition, farming, commerce, etc). All the coalition

partners realized that collectively they could work at a faster pace, and achieve their objectives more quickly than they would have by working in isolation. The 'coalition' allowed capitalizing on the synergies from sharing of skills from different disciplines with each member playing his/her role in the project. The conflicting interests of different stakeholders were addressed mutually in reaching the final goal.

As indicated earlier, the broiler PFTs were repeated to meet the requirements of the industry, and the layers feed trials were carried out for *commercial layer birds* also to address concerns of poultry producers. Although hypothetical, it is probable that if the scientists had been working in isolation, the poultry producers and feed manufacturers would have been less satisfied with the methods and results. The testing would not have reflected their own practices and concerns, and they would not have been in a position to make requests for adjustments after the results had been published. Innovation within the project does appear to have been propelled by linkages between people. Learning from past experience, combining different perspectives to give rise to new, synthesized ideas, and what Barnett has called 'creative imitation' (Barnett 2004), were all the product of the exchange of knowledge and experience between individuals and groups.

Lessons learnt

- The clarity and appropriateness of roles – agreed jointly at the beginning of the project – was recognised as an important ingredient of success. The monitoring plan, for example, stipulated the precise responsibilities of each partner organisation in relation to each other.
- Working in partnership required great emphatic ability and clarity on the roles each partner has to play to achieve the common overall goal of the project.
- Consensus decisions and frequent communications considered as important ingredient in the success of this attempt
- Since bulk storage is a problem in the project villages, this creates some problems related to grading and scientific storage practices. Hence storage structures are needed for success of such activities.
- The linkage between the credit and output market ie, tied transactions was one of the reasons for sales outside the Farmers Association. Need for credit from formal sources.
- Need to explore informal/formal agreements through novel market linkage models for long-run sustainability of the market linkages between the farmer and the feed industry
- More critical examination of roles and responsibilities of Farmers Association.

To address some of the above concerns and to take on board the lessons learnt, a project is now being implemented on “Enhanced utilization of sorghum and pearl millet in poultry feed industry”. This project covers a larger area, and includes sorghum and pearl millet that are grown by small-scale farmers, and have potential in poultry feed. The main emphasis under this project is linking producers with feed industry by involving all stakeholders under a coalition approach. The innovative supply chain envisaged under the project is shown in Fig. 39. Input dealers and bankers will be part of the supply chain and there is provision for storage structures at the village level for bulking and grading of produce.

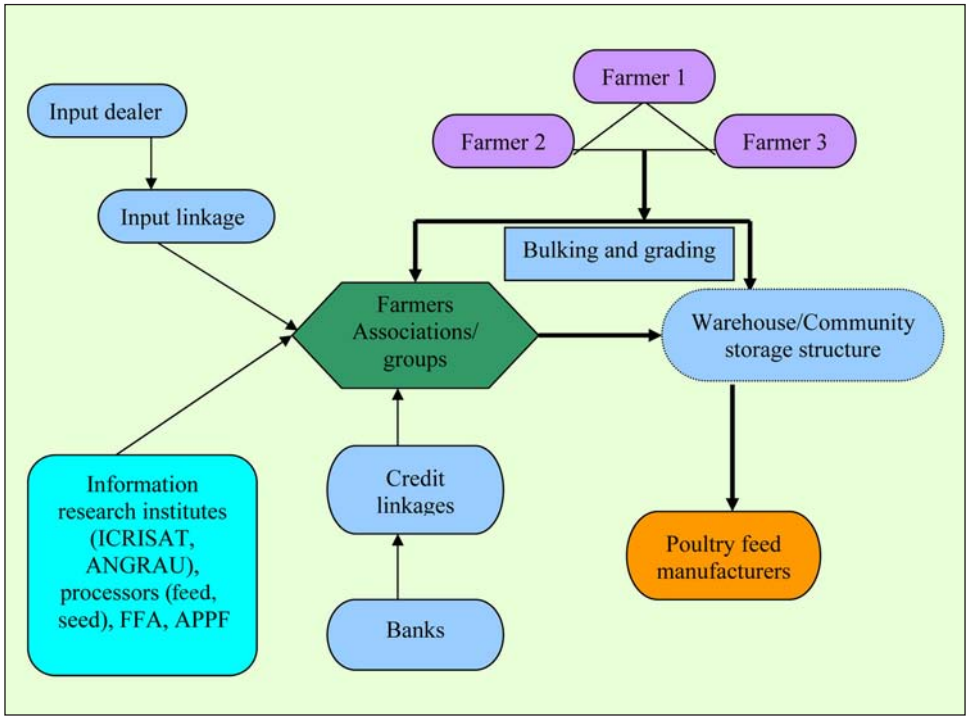


Fig. 39. Innovation in supply chain.

Concluding remarks

Creating market linkages led to four clear benefits: (1) established that sorghum could be used in poultry feed without impairing its quality and convinced poultry producers and feed manufacturers; (2) the farmers and feed manufacturers worked together to ensure the quality of the grain was suitable for poultry feed; (3) the supply chain was shortened and some middlemen made redundant, thereby decreasing the transaction cost to both farmers and feed manufacturers; (4) the direct link to industry gave the farmers the incentive to operate collectively, which increased their bargaining power and reduced marketing and transportation costs.

It is too early to assess the impact of the above project on market linkages but a good beginning has been made. The beauty of the coalition approach was that while all the partners/stakeholders worked towards a common goal, each stakeholder had their own smaller goal to achieve. For example, the crop breeder got feedback on sorghum cultivar traits preferred by the farmer, the poultry nutritionist gained knowledge on use of sorghum in poultry rations, the feed industry gained knowledge on poultry feed formulations with sorghum and the farmer, knowledge on improved cultivars, bulking and linkages to a potential market. Thus, although the stakeholders come from different institutions/organizations with different objectives, the common underlying goal is an important binding factor.

The biggest lesson from this project is perhaps the recognition of the need to involve all stakeholders who have some stake in the commodity under consideration. This ensures that stakeholders do not work at cross-purposes defeating the final goal.

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