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Transferring an Indigenous Practice for Soil Improvement: Cattle Manure with Groundnut Shells

Crop production in dry regions is dependent on the vagaries of the monsoon. Low rainfall regions are exhibiting reduced yields as well as declined soil productivity. Furthermore, the cost of production using external inputs is constantly rising making farming in most situations uneconomical. The basic challenge is to make better use of available biophysical and human resources, which can be done by minimizing the use of external inputs and by utilizing and regenerating local/ internal resources more effectively (Rodale, 1995). Soil fertility never used to be a major constraint due to the age-old practices of recycling agricultural residues in several ways. However, in these days of inorganic fertilizers and quick returns, the problem of soil management and its related constraints are surfacing. In this context, indigenous practices related to soil and water conservation which can also be termed resource-conserving technologies need to be documented in a systematic way and also to be analyzed and introduced to potential new areas. Preparation of valuable manure from groundnut shells spread on the floor of the cattle shed is one such indigenous practice followed by farmers of Anantapur district in the state of Andhra Pradesh in India. This age-old practice is still practiced by the farmers of this region. The details of the practice are as follows.

The Practice

Spreading groundnut shells under the cattle as bedding in the cattle shed generating Groundnut Shell Manure (GSM) is the practice. After the shell becomes soaked with cattle urine and mixed with dung (1-2 days), it is removed and heaped. This process continues throughout the year depending upon the quantity of material available. With the onset of the rains, manure from the heap is spread in the fields just before preparatory cultivation.

The farmers of Anantapur district have been following this practice for several decades. In sheds where bullocks are housed, the material is left on the floor for only one day as bullocks trample more, while in the sheds housing cows and buffaloes, the material is changed every alternate day. Shells keep the floor of the shed dry leading to better hygienic conditions. After 1 or 2 days, the material is removed and heaped and allowed to decompose for 2-2.5 months. Decomposition is quicker due to the presence of moisture in the form of cattle urine. The quantity of shell manure prepared depends on the quantity of shell used and the number of animals.

Groundnut crop has a shelling percent *of 60-70, i.e.*, of the total pod shelled, 60-70% is the seed and 30-40% is the shell, leading to generation of large quantity of shells (around 300 kg per hectare per year under rain fed conditions).

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Farmers' Perception of the Practice

- Practicing this technique for the past two decades helped farmers reap a better harvest even during a drought year when the whole neighbouring area was affected by drought.
- Besides meeting the nutrient requirements of the crop, shell manure had beneficial effects such as improving the soil structure and water holding capacity etc.
- Application of groundnut shells loosens the soil. Therefore, peg penetration becomes easier and weeding and harvesting become more manageable.
- Spreading of shells as bedding ensures hygienic conditions.

Scientists' View and Analysis

The analysis has indicated that the groundnut shells have the composition of 1.19% nitrogen, 0.08% P_20_5 and 0.55% K_20 with carbon of 34%. The C N ratio of this material is about 28.

Cattle urine contains about 1.00% Nitrogen traces of P_20_5 and 1.0% of K_20 and approximately 2400-2500 litres of urine are produced per year per animal (Yawalker *et.* al., 1996). If this urine were not conserved, nitrogen in the urine, which is mainly in the form of urea, would be quickly lost as ammonia. This loss can be reduced to a great extent by conserving the urine using groundnut shells. If the whole quantity of urine is conserved through this method, about 20 kg nitrogen and 20 kg K_20 can be saved per year per animal. In addition to this, each animal produces 5-7 tomes of dung containing 0.2-0.35% N, 0.1-0.15% P_20_5 and 0.2-0.3% K_20 nutrients. Therefore, the farmers through this indigenous practice can effectively utilize the renewable resources of dung and urine along with the large quantities of crop residues (groundnut shell).

Combining the nitrogen rich groundnut shell (1.19%)with another rich source of nitrogen, i.e., cattle urine (0.83), followed by FYM (0.52%) led to nitrogen (1.75%) and potassium (0.62%) rich groundnut shell manure. Not much improvement was observed with regard to phosphorus (Table 1). Through the conservation of urine in this manner, the loss of soluble mineral elements is prevented, bacterial decomposition of raw organic matter is encouraged, plant nutrients are made soluble and nitrogen losses are minimized.

Soils from the practicing farmers' fields when analyzed (Anantapur region) showed improvement in the available nitrogen by 50 kg ha $^{-1}$ when applied continuously for four years, increasing the pod yields by 200 kg ha-^{l}. Not much significant improvement was observed with one year of application of shell manure either in the yields or in the available nitrogen (Table 2).

Table 1. Nutrient Composition of Different Materials in use under Experimentation

Material	N%	P%	K%
Groundnut shell	1.19	0.08	0.55
Groundnut shell manure	1.75	0.18	0.62
FYM	0.75	0.22	0.4i

Table 2. Nutritional Status of Different Soils Collected from Anantapur Region of Andhra Pradesh, India

Source of Soil samples	Organic Carbon (%)	Available Nitrogen (kg ha}	Available Phosphorus (kg h a)	Available Potassium (kg ha^{l}) (kg ha ^{l}k)	Pod Yields (kg ha^{l})
Untreated (Groundnut shells not applied)	0.30	180	18.5	120	400
Soil application of groundnut shell manure for one year	0.35	190	25	140	450
Soil application of groundnut shell manure for 4 years	0.4	230	27	156	600

Introduction of the ITK Practice to New Areas

In view of the above advantages in terms of use of residues, the reduced use of inorganic (external inputs) and improved use of renewable resources like cattle urine, reduced use of water in preparing the manure, improved physical and chemical conditions of the soil, which will improve the yields of crops especially under drought conditions, an attempt was made to introduce this practice to Anantapur district, which displays similarities in agro-climatic conditions, soils, cropping system and the socio-economic conditions of the farmers.

The Process of Introduction

A preliminary survey was conducted to select villages based on the prevailing crops and cropping systems, and the practices related to management of soil through organics. The majority of small (50%) and marginal farmers (25%) cultivate mostly sorghum, castor, groundnut, and maize during the monsoon season and groundnut again in the post monsoon season with minimum irrigation. The farmers know the importance of organic manures and are applying half to one tonne of farmyard manure per acre whenever, it is available. Besides this, they are applying complex fertilizers like 14-35-14 or 17-17-17 N, P_2O_5 and K_2O respectively and gypsum @ 500 kg per hectare at the time of flowering. Sheep penning once a year, an age-old practice, is in vogue in these villages. After the survey, a Gram Sabha (Village Assembly) with the villagers was conducted to extract any information related to the earlier mentioned indigenous practice. This was followed by an interaction with 45 farmers who revealed that crop residues, for instance, groundnut shell, are thrown in the manure pits near the cattle sheds. The farmers are aware of the loss of cattle urine which is a renewable resource.

A focus group meeting was conducted with 20 farmers, on the basis of the crops they grew and irrigation facilities available. This was followed by an interactive capacity building meeting to educate 15 farmers selected to conduct the demonstration trials about the preparation of groundnut shell manure. In the participatory mode, the procurement of groundnut shell was carried out by the 15 farmers to make them understand the price/value of groundnut shell. The farmers were guided in the preparation of groundnut shell manure (GSM). They were allowed to use their wisdom in preparing the GSM. Surprisingly, one farmer from the Mahabubnagar district of Andhra Pradesh, India, came up with the idea of putting the soaked layer one over the other in the cattle shed whose floor is of soil. The reason he gave was that the layer existing below will not get dried and will not lose the element of nitrogen. This experience showed that the farmers could still improve the practice locally.

To demonstrate the value of GSM application, simple experiments were conducted on groundnut crops in 15 farmers' fields by applying GSM, compost, groundnut shell in comparison with the farmers' practice, regenerative treatment of only organics and recommended dose of fertilizers. After 2 years of experimentation, it was observed that during the monsoon season, with the application of GSM, groundnut crop yielded 10-15% higher yield than the Farmers' Practice, but equivalent to compost applied fields. However, the application of groundnut shell and regenerative treatments to the fields yielded similar results and more or less equivalent to Farmers' Practice.

The groundnut crop during the post monsoon season, when grown under irrigation, yielded 20-25% more yield than the Farmers' Practice. The application of groundnut shell as such did not have any significant effect during the monsoon season, while its effect improved during the post monsoon season due to the availability of water.

The retention capacity of soil moisture content (%) when monitored at the time of a critical stage i. e., peg (the stalk of the pistil of the :flower) penetration stage, the retention capacity was more in the GSM applied fields compared to the farmers' practice. The increased moisture retention was observed to be in the range of 0.9%-5.1%. Increased pod number per plant, maximum filled pods per plant and better 100 seed weight of crop grown in GSM applied field had resulted in higher yields.

Perceptions of farmers in the region of introduction

The farmers were very enthusiastic about the advantages of utilizing crop residues for recycling. In place of water for composting, which is a great constraint in the dry lands, cattle urine for quicker decomposition is being used as a renewable energy source. Also, a dry environment would be provided for cattle besides acting as an absorbing material and facilitate cleaning of the floor.

Conclusion

Through this method of bedding the cattle shed with agricultural residues, an effort was made to recycle at least a part of the dry matter harvested from the field. Since the farmer can carry out this practice routinely, he/she never feels an additional burden. Further, the farmers realize the importance of organic manures to the soil.

Indigenous Knowledge, while it springs from local resources, local people and is used for solving local problems, can with refinement and adaptation, become global knowledge. The farmers readily accept simple techniques displaying sound logic, when it fits into their routine, and if they are cost effective. This indigenous practice of cattle shed bedding with groundnut shells becomes global knowledge when locally available residues are involved. The principle in this documented practice can be adopted by not only the groundnut-growing regions, but also by the areas where other crops grow i.e., any crop residues which is not useful as cattle feed can be tried for bedding the cattle for recycling depending upon the quantity of material available. It is also cost-effective in rural locations where the alternative use of groundnut shells is not significant.

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