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**Sanjay-Swami**

Senior Scientist and Head, Krishi Vigyan Kendra-Poonch, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu and Kashmir, India

## Traditional methods of maintaining soil health in Poonch district of north-west Himalayas

**Sanjay-Swami****Abstract**

Poonch is one of the hilly, tribal, remote and border districts of Jammu and Kashmir in the North-Western Himalayas. Mostly, farmers of the district are economically backward and uneducated belonging to *Gujjar* (who tend cattle and buffaloes) and *Bakarwal* (who rear sheep and goats) communities. These communities rear livestock along with arable agriculture. Livestock is the primary subsistent activity used to meet household food needs as well as supplement farm incomes. They are extremely rich in their indigenous knowledge and techniques and are playing significant role in maintaining soil health from ancient time. Addition of FYM, *in-situ* manuring, increasing soil faunal diversity, spraying of ash, keeping agricultural land fallow for one season, terrace cultivation, etc. are just a few of the hundreds of traditional eco-friendly soil health management practices performed by the farmers of Poonch district. The uniqueness of these practices is their suitability to the local conditions, their economic feasibility and easy implementation. As one practice compliments the other one, if they are applied in combination, they tend to be even more effective in protecting and maintaining soil health. However, few of these techniques require certain scientific modification/intervention to improve their efficiency.

**Keywords:** gujjar and bakarwal, traditional methods, soil health, north-western Himalayas

**Introduction**

Hill and mountainous areas in India are vastly distributed all over the country with a larger area located in Himalayas, extending up to 2,500 km in length and 250 to 400 km in breadth. The dominant features of hill farming in North-West Himalayas are small land holdings, sloping marginal land, rainfall-dependent farming and shallow soils prone to erosion, which is aggravated by heavy migratory grazing that led to soil degradation (Fatima and Hussain, 2012) [1].

Poonch is one of the hilly, tribal, remote and border districts of Jammu and Kashmir (J&K) situated in the *Pir Panjal* range of North-Western Himalayas. It is bounded by the Indo-Pak Line of Control (LOC) from three sides. The total geographical area (excluding occupied area) of the district is 1674sq km. The average size of land holdings is quite low as it is 0.20 ha only. The average annual rainfall in the district is about 1225 mm with 56 to 73 average rainy days. Higher reaches of *Pir Panjal* receives snow fall in winter months. Majority of the fields in this district are situated across the hilly slopes which demand a treatment little different from the standard followed in the mainland plain areas. Soil is the most crucial input in deciding the agricultural productivity. Mostly, farmers of the district are economically backward and uneducated belonging to *Gujjar* (who tend cattle and buffaloes) and *Bakarwal* (who rear sheep and goats) communities.

The main occupation of these communities is practicing arable agriculture along with livestock rearing. Livestock is the primary subsistent activity used to meet household food needs as well as supplement farm incomes. The pattern of livestock strength is mainly influenced by various factors such as farm size, cropping pattern, availability of range-lands including fodder and pasture. *Gujjar* and *Bakarwal* are extremely rich in their indigenous knowledge and techniques. They have developed and refined this knowledge and techniques over centuries by carrying out farming under diverse, uncertain, risky and fragile ecological conditions. Therefore, the present study was undertaken to find out, understand and document the traditional methods of maintaining soil health practiced by the *Gujjars* and *Bakarwals* communities of the North-West Himalayas.

**Correspondence****Sanjay-Swami**

Senior Scientist and Head, Krishi Vigyan Kendra-Poonch, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu and Kashmir, India



Plate 1 & 2: *Gujjar* and *Bakarwal* with their livestock

### Material and Methods

An intensive field study was undertaken among the farmers of *Gujjar* and *Bakarwal* communities in purposively selected ten villages of Poonch district. Elders, both men and women were consulted and their narrations on various concepts of maintaining soil health were recorded.

### Results and Discussion

The results revealed that *Gujjars* and *Bakarwals* are fully aware of the fact that regular recycling of organic wastes in the soil is the most efficient method of maintaining optimum levels of soil organic matter. Organic manures play an importance role in crop production and sustainable agriculture development. In intensive cropping system, the use of organic manures is very less and resulted to decline in crop yields and increases the soil health problems (Sanjay-Swami, 2017a) [5]. However, the indigenous methods of maintaining soil fertility are the time tested ones by the *Gujjar* and *Bakarwal* communities. These methods are presented in Table 1 along with their scientific rationale followed by detailed description of each method.

Table 1: Traditional methods of maintaining soil health practiced by the *Gujjars* and *Bakarwals* along with their scientific rationale

Traditional methods	Scientific rationale
Addition of Farm Yard Manure (FYM), locally called as <i>gotha</i> or <i>pah</i>	Maintaining optimum levels of soil organic matter and source of plant nutrients
<i>In-situ</i> manuring	Reduction in transportation cost of manures to the fields located at higher altitudes
Soil faunal diversity	Increasing soil biological activity, soil aeration, fast decomposition of organic matter
Spraying of ash	Enrichment of soil in phosphorous
Fallowing of land	Providing time to soil for convalescence
Terrace cultivation	Reducing soil erosion and nutrient loss

### Addition of farm yard manure (FYM)

Addition of farm yard manure (FYM), locally called as *gotha* or *pah*, is one of the most useful and significant indigenous methods practiced by the *Gujjar* and *Bakarwal* almost in every village of the district from ancient time. This involves using of fully decomposed organic matter of livestock dung, straw, grasses, left over feed, etc. An average size cattle produces around 4-6 tonnes of fresh dung per year. The leaves used for animal bedding not only keep the livestock clean and warm but are also used to maintain or enhance the fertility level of the soil as these are used for making organic manure. For this, the *Gujjar-Bakarwal* women dump animal dung/wastes regularly in the open at one place in the shape of heap and allow it to degrade naturally without any amendments. After fully decomposition, the FYM is shifted to the fields and mixed thoroughly in the soil. According to scientific studies on organic manures, animal dung used as manure contains on an average 0.35% nitrogen, 0.15% phosphoric acid and 0.20% potash (ICAR, 1966). More importantly, only about 35, 65 and 75% of the available N, P, K, respectively, from the manure are absorbed by the first crop after application (Garg *et al.*, 1973; Tandon, H.L.S., 1992) [2, 8], and the rest are available to subsequent crops as residual effects. These observations confirms the findings of Garg *et al.*, (2005) [3] and Sanjay-Swami (2012, 2017b) [4, 6] who reported that animal wastes are important resources to supplement organic matter and improve soil conditions.

Sanjay-Swami *et al.*, (2018) [7] also reported that the farming system of North Eastern Hill region of India also has close linkage and interdependence with animal husbandry and forest. Organic matter derived from domestic animals and surroundings forest is considered as an important input in the farming system. Majority of the household maintain livestock *viz.* pig, poultry, cattle, mithun, goats, etc. producing sufficient quantity of farm manure which is efficiently used for maintaining soil health. Similarly, each village has a specific place called *golgotha* (soil of cow gathering place) where the cows gather during morning and noon time. The dung and urine of the cows are mixed with the soil and this soil is used as manure in vegetable fields.

The quantity of FYM used for field application depends upon the number of livestock reared, proximity to the forest, extent of land as well as the manpower available. If soil has to be prevented from becoming barren, it is necessary to apply 10 bullock cart loads or 5 tonnes of dung manure for each acre of land. With the application of FYM, earthworms also get introduced in the cropland as large numbers of earthworms are present in the place where organic decomposition of animal dung takes place and increase the fertility of the soils.





**Plate 3 & 4:** Natural composting of animal dung by *Gujjar* and *Bakarwal* women

Although, it is a time taking process, yet good FYM can be prepared within a period of about 6-8 months of continuous open-air decomposition of animal dung with other leaf litter. Farm women in the higher altitude areas maintain two cattle sheds - one near to their village and another near to their agricultural fields to reduce the labour in carrying the FYM. In this practice, they only shift their livestock from one cattle shed to other according to the growing season of different crops.

During the study, it was observed and realized that the traditional method of preparing and storing FYM practiced by the *Gujjar* and *Bakarwal* communities is faulty. The animal dung together with stable waste and house sweepings is heaped loosely. The loose heap lie exposed to sun and the raw organic matter dry up. In rains, it gets drenched and all the soluble nutrients get leached out from the manure. Also, while the organic matter decomposes, the ammonia etc. escapes in to atmosphere. The wastage of nitrogen rich urine, the loss of nitrogen due to the fermentation of exposed animal dung, washing away of soluble mineral elements by leaching etc. reduce the manurial value of the FYM.



**Plate 5:** Addition of *gotha* or *pah* in fields

#### ***In-situ* manuring**

The *Gujjar* and *Bakarwal* also put into practice their traditional knowledge of *in-situ* manuring. In this practice cow, buffalo, sheep and goats were used to left in open fields for 2-3 days for their dung and urine. *In-situ* manuring is mainly employed before the sowing of *Rabi* crops (winter crops) at higher altitudes where people had large number of sheep and goats. These results are in close conformity with the findings of Sanjay-Swami *et al.*, (2018)<sup>[7]</sup> who reported that the tribal farmers of Arunachal Pradesh in NEH region

also adopt the traditional practice of temporary community confinement of Mithun in fields, locally known as *Lura* for *in-situ* manuring.

#### **Soil faunal diversity**

The indigenous methods of maintaining soil fertility by increasing the soil faunal diversity *viz.* earthworms, ants, arthropods, nematodes, mycorrhiza, etc. are the time tested ones by the *Gujjar* and *Bakarwal* communities of the North-West Himalayas. The same concept is also followed by tribal farmers of hilly areas in Himachal Pradesh, Uttarakhand and North Eastern Hill region (Sanjay-Swami *et al.*, 2018)<sup>[7]</sup>.

#### **Spraying of ash**

Spraying of ash is a common and indigenous practice followed by the *Gujjar* and *Bakarwal* for the sake of increasing fertility of the various crops. The amount of ash applied has not been yet quantified but mainly practiced for crops like onion (*Allium cepa* L.), garlic (*Allium sativum* L.), coriander (*Coriandrum sativum* L.), and spinach (*Spinacia oleracea* L.). Through this practice, they also enrich soil in its phosphorous content for the next crops. The spraying of ash is also performed by tribal farmers in North Eastern Hill region in vegetable crops (Sanjay-Swami *et al.*, 2018)<sup>[7]</sup>.

#### **Fallowing**

Keeping agricultural land fallow for a brief period of 4-6 months is a general practice in the rainfed areas of Poonch district located at higher altitudes like Mandi, Loran, Chandimarh, etc. In these areas, no crop is cultivated during *Rabi* season due to extreme cold from December to March. The fields remain covered with heavy snow that leads to very low temperature. Based on in-depth knowledge and long experiences, farmers well recognized that fallowing of land provide time to soil for convalescence, which otherwise gets exhausted due to intensive cropping. Tribal farmers of North Eastern Hill region also keep their fields fallow after paddy cultivation in *kharif* to provide time to soil for convalescence. However, the reason for fallowing in this region is scanty rainfall during *rabi* season as well as non-availability of irrigation water (Sanjay-Swami *et al.*, 2018)<sup>[7]</sup>.

#### **Terracing**

Terracing is a critical aspect of rainfed agriculture in the hilly areas of Poonch district. They not only substantially reduce erosion but also make it easier to carry out practices like zero tillage. Inhabitants of low and mid altitude villages grow fodder and fuel wood yielding trees on the bunds of their crop fields to check soil erosion and nutrient loss. The similar practice of terracing is followed by tribal farmers in North Eastern Hill region of India (Sanjay-Swami *et al.*, 2018)<sup>[7]</sup>.

#### **Conclusion**

The *Gujjar* and *Bakarwal* communities of Poonch district are playing a significant role in protecting soil health through organic recycling from ancient time. Application of FYM, *in-situ* manuring, increasing soil faunal diversity, spraying of ash, keeping agricultural land fallow for one season, terrace cultivation, etc. are just a few of the hundreds of traditional eco-friendly soil health management practices performed by the farmers of Poonch district. The uniqueness of these practices is their suitability to the local conditions, their economic feasibility and easy implementation. As one practice compliments the other one, if they are applied in combination, they tend to be even more effective in protecting

and maintaining soil health. However, few of these techniques require certain scientific modification/intervention to improve their efficiency.

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