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BROWN MANURING A RELIABLE METHOD IN DIRECT SEEDED RICE

Mahendra N. Wairagade

Email
mahendrawairagade@gmail.com

Department of Agronomy, College of Agriculture, Dr. BSKKV, Dapoli (M.S.), India

Brown manuring is simply a 'no-till' version of green manuring, using a selective herbicide to desiccate the crop before flowering instead of using cultivation. According to this technique, green manure crops are grown along with the crop and killing them with the help of herbicide. The plant residues are left standing in the field along with the main crop without incorporation/in-situ ploughing until its residue decomposes itself in the soil. It helps to add organic manure besides weed suppression by its shade effect. The post-emergence herbicide spray on green manure leaves resulting in loss of chlorophyll in leaves showing brown in colour is referred to as brown manuring.

Brown manuring is similar to green manuring, except the fact that rice and *Sesbania spp.* are both grown together and when these Dhaincha plants overtake the rice plants in height at about 25 days of co-culture, a weedicide 2, 4-D is applied to kill these *Sesbania* plants. After 4-5 days of spraying *Sesbania* plants will appear brown and then start dying. As it is a selective herbicide, it kills only *Sesbania* plants and not the rice plants. This is called knocking down effect. Brown manuring is usually recommended for the rice which is directly seeded, but not when transplanting is done. If the rice is broadcasted then at the time of beusaning dead *sesbania* plant parts will be incorporated in soil, whereas, in case of line sowing at the time of weeding it mixes in the soil supplying the nitrogen and other nutrients to rice.

Crops Suitable for Brown Manuring

Non-leguminous crops: The non-leguminous crops which provide only organic matter to the soil are used to a limited extent. Example: Niger, Wild indigo *etc.*

Leguminous crops: Crops provide organic matter along with nitrogen to the soils. The legumes are preferably used, and they can fix atmospheric nitrogen with the help of its nodule bacteria. Example: Sun-hemp, Dhaincha, Mung, Cowpea, Lentil *etc.*

Generally, brown manuring in rice is the practice of growing *Sesbania spp.* and rice together, and when these Dhaincha plants overtake the rice plants in height at about 25 days of co-culture, a weedicide 2, 4-D is applied to kill these *Sesbania* plants. After 4-5 days of spraying, *Sesbania* plants will appear brown and then start dying; leaves will fall on the ground and form mulch and help in smothering of weeds. As it is a selective herbicide, it kills only *Sesbania* plants and not the rice plants. This is called the down knocking effect.

Sesbania is a live cover that offers interference (at pre-killing period) with weed and later as a dead residue mulch offers stimulation by addition of organic matter (at post-killing period). As brown manure crops are grown between the lines of the major crop, so planting density in the field was high, due to which there would be no free space available for weed for its spread resulting in a minimum weed population. In brown manuring, knocking down of *Sesbania* by 2,4 D application fasten the decomposition and release of nutrient present in *Sesbania* as compared to in-situ incorporation. *Sesbania* could add C and N into the soil, which facilitates favourable microbial action. Also, during the decomposition of *Sesbania*, certain organic acids, allelochemicals are released, which might offer some depressive effect on the weed seed bank. Enhanced soil fertility as well as lesser weed competition under brown manuring treatment, leads to higher productivity of crops.

Qualities of an Ideal Brown Manure Crops

- Seeds of the plants should be easily availability and cost effective.
- It should be easy to cultivate and have vigour growth.
- High dry matter production in less span of the crop.
- It should have competitiveness with target weeds.
- The crops should have high ground cover to reduce wind erosion and conserve moisture.
- It does not compete with the main crop

Social Feasibility of the Technology

- The technology is more suitable for risk prone agro-ecosystems in which direct seeding of rice is done.
- As most of the Indian rice growers are resource poor, the technology can add more benefit with very marginal input cost.

Benefits of Brown Manuring

- Soil organic carbon content is increased by brown manuring, thereby supplying the required nitrogen for the rice plants. Thus, a part of nitrogenous fertilizer (up to 25%) can be replaced by brown manuring.
- It also increases the crop yield.
- Biomass of green manure conserves moisture.
- It also improves the soil health parameters like organic carbon content and earthworm population of the soil.
- Brown manuring improves the physicochemical and biological properties of the soil.
- Brown manuring reduces the weed population in the early stage due to its high growth rate and competition with the weeds.
- Brown manuring increasing soil organic matter, which decreases the bulk density of the soil and acts as a buffer preventing or lessening the transmission of compaction to subsoil from external loads acting on the topsoil

Green Manuring V/S Brown manuring

Green Manuring	Brown manuring
It is the incorporation of a manure crop by tillage before seed set usually around flowering	It is a no-till version of green manuring, where herbicides are used to kill the manure crop and weeds
Risk of soil surface erosion	The plants are left standing so it protecting lighter soil from risk from soil erosion
Moisture is necessary for incorporation and decomposition.	Moisture is conserved during the practice
The microbial population is necessary for decomposition	Chemical desiccation will take place

Conclusion

Considering the increasing cost of chemical fertilizers, brown manuring can be seen as an alternate path to higher production and productivity of the crops and therefore enhancing the income of farmers. Brown manure is the perfect cost-effective way in nutrient management strategy for crops to improve production and to restore soil quality which in need of today's agriculture. By the significant advantages in environmental sustainability and enhances overall soil quality with least usage of herbicide application, the brown manuring method should actively promote by the extension agencies to reap its advantages by the farming community.

References

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