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# GREEN MANURE FOR IMPROVED WHEAT YIELD THROUGH MOISTURE CONSERVATION IN RAINFED AREAS OF PAKISTAN

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### ABSTRACT

Successful conservation of diminishing water and land resources are needed to feed an ever increasing world population. Green manuring is one of the methods adopted to conserve moisture in the soil and keeping in mind the needs of arid agriculture its importance becomes more conspicuous. The adoption of insitu moisture conservation techniques in addition to the large scale soil and moisture conservation and water harvesting structures in the watershed is imperative to increase the moisture availability. The principle factor behind these recommendations is to reduce runoff, temporarily impounding the water on surface of soil to increase the opportunity of infiltration. Cover crops like cowpea green manure believed not only to improve the organic matter content of the soil but also to enhance insitu moisture conservation. These crops are planted in June at the onset of Monsoon and allowed to stand in field up to mid August when they started bearing flowers. Later they are incorporated into the soil and the conserved moisture proved beneficial for the forthcoming wheat crop

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**Keywords:** *Cover crop, green manuring, Insitu Moisture conservation.*

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### INTRODUCTION

Land and water are the fundamental natural resources for sustainable livelihood to all forms of life. Both of these are limited to meet the demand for food, fuel wood and timber (Mishra and Rai, 2013). Soil degradation is a major threat to the Earth's ability to feed itself as nearly 40% of the world's agricultural land is seriously degraded (Kirby, 2000). Crop production under dry land farming condition depends upon rainfall which is limited and seasonal in these areas. (Farahani 1998, Sandhu, 1992, Mosavi, 2012). The best agricultural management practice in these areas would be increasing the water conservation and ability of soil to store the available water (Mosavi, 2009). For this it is indispensable to improve the soil structure, infiltration rate and water holding capability of soil (Martens and Franken 1992). Aggregate of soil are the basic units of soil structure and organic residues application have been revealed for improve structure (Caravaca, 2001). Soil loosening decreases bulk density while compaction increases it. The magnitude of change depends upon the antecedent soil properties, soil wetness and time and intensity of operation (Gajri and Prihar, 1994). On compacted soils, the deep ploughing improved air permeability and soil water diffusibility (Majid, 1986). Land degradation has been an important global concern for the last many decades due to its negative effects on crop productivity and its impact on food security (Eswaran, 2001). Erratic rainfall and loss of water through runoff are main agriculture problems in the sloppy lands of the dryland farming area. Huge losses of soil in rainfed areas because of

erosion has caused frustration among the inhabitants, therefore, many of them have chosen alternate professions. The loss of soil through runoff is occurred by high intensity of rainfall, low vegetation and low organic matter of the soil. It is also reported that soil loss is nearly proportional to exposed ground cover. He added that soil loss under an effective vegetal canopy of 60 percent (40 percent exposed soil) would be four times the loss under a 90 percent canopy (10 percent exposed soil) (Palis, 1994). Inadequate vegetation cover provided by rainfed crops causes serious problem of soil erosion, excessive runoff, flash-floods, formation of gullies and overall deterioration in quality, fertility and productivity of land gullies. The plantation of suitable multi purpose trees and perennial forage and commercial grasses may provide the much needed protective cover to such degraded lands (Grewal, 1992).

The other problem of rainfed areas is moisture stress; long dry spells effect the crops, while sometime rain may be enough for both winter and summer crops but improper water conservation leads to poor crops (SAWCRI Annual Report, 2011-12). Because of uneven topographic features, unequal distribution and erratic rains, major portion of rainwater is lost as run-off, which can be utilized for enhancing agricultural production if properly conserved. As the moisture is the limiting factor in the rainfed farming and the rainfall is the only source of water for these lands, it is necessary to conserve rain water and to maximize the retention of moisture. Indigenous practices play an important role in development of sustainable Agriculture and feeding an ever increasing population (Karthikeyan, 2008).

**GREEN MANURE AND MOISTURE CONSERVATION**

Cover crop referred to any crop planted for providing the living cover on ground. They served as Best management practices to overcome the problems of soil erosion, leaching of nutrients, weed suppression and improving the fertility status of the soil (Dabney et al., 2001). Green Manuring practice referred to incorporation of cover crop in soil in order to improve the soil fertility in addition to improving the physical properties of soil (Sullivan, 2003; Janzen and Schaalje, 1992). A number of crops such as cowpea, Guar, Sesbenia can be used as green manure. Data showed that there is an increase of 9 % in infiltration rate by green manure incorporation in soil as compared to control treatment (Mosavi et al., 2012). It showed that more water contents are available in soil for crop growth. Cowpea green manure has been found to be most economical and effective in improving the infiltration rate and wheat yield from 15- 20 % (SAWCRI Annual report 2010-11).

Pakistan agriculture is classified as irrigated agriculture with about 18 million hectares (Mha) of irrigated area contributing 90% of total agricultural produce. The area with potential for agricultural production, if water is made available is 26 Mha (SAWCRI Annual Report 2011-12). The rainfall statistics showed that about 75 % rainfall occurs during Monsoon season (June-August). If we look at the temperature statistics and cropping pattern of the area there field is at fallow during these months. It means that the bare soil is more exposed to the dangers of soil erosion, leaching and loss of moisture through evaporation. Any crop cover during that time will not be a blessing for soil but also yield the forthcoming wheat which is an important staple food crop of Pakistan.

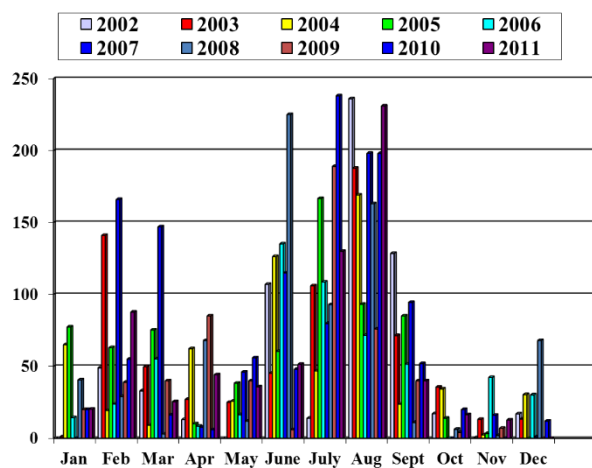


Figure1. The total amount of water required by crop during its production period is known as water requirement. It varies among different crops

**SOURCE: METROLOGICAL DATA 2001-2011 SAWCRI CHAKWAL**

Soil and water conservation research institute Chakwal has tested this hypothesis through experimentation over many years at its research area as well as on farmer's field. It has been proven that green manuring with cowpea during Kharif season, specified for wheat during Rabi, increased wheat grain yield up to 10-19 % in rainfed tract. There is also an increase of about 37 % in number of tillers as compared to the control treatment. The technology has also yielded promising results regarding the cost

to benefit ratio which is 1: 1.45 in green manuring as compared to 1: 1.35 in farmer practice (Annual Report 2011-12, SAWCRI). The crop cover treatments significantly reduced both runoff and soil loss. As compared to 35% per cent mean runoff from the bare plots, crop cover treatments yielded only 19 per cent. Cropped treatments responded differently in checking runoff as the different crops developed variable leaf area index during the growth period. Mean soil loss under bare and cropped treatments was 20.2 and 6.7 t ha<sup>-1</sup> respectively (Khera and Kukal, 1994).

### CONCLUSION

Incorporation of green manure in soil has multiple benefits that include the improvement of soil quality, improved infiltration rate and control of pests (Hartwig and Ammon, 2002). Future Research needed to understand the mechanism of incorporation of green manure in cropping systems and to prevent obstacles in technology adaptation. Addition of Green manure brings costs as well as benefits so consideration should be made keeping in view the (1) Farmer objective (2) Soil fertility status (3) climatic concerns (4) cropping pattern and the nutrient scavenging ability.

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