Optimum Usage of Water By Using Mulching Irrigation: A Sustainable Approch

Prof Sharayu Turkhede[1], Aniket Shintre[2], Gopal Bhutekar[3], Sushant Pawar[4], Mangesh Kakade[5]
[1]Assistant Professor, Dept of Civil Engineering
[2, 3, 4, 5]Dept of Civil Engineering
[1, 2, 3, 4, 5] Dhole Patil college Of Engineering, Wagholi, Pune, India

Abstract- *The paper mulching, by conserving soil-moisture and re- ducing soil temperature, provided better crop growth attributes, while the plastic mulching improved WUE of green soybean. Therefore, the plastic mulch performed best in reducing soil-water consumption and increasing WUE, while the paper mulch was good for soil-moisture conservation and temperature modification that increased soybean yield*

Our objective was to examine the effect of plastic mulching, three soil matric potentials (SMP) treatments {I1(-20 kPa), I2(-40 kPa), and I3(-60 kPa)} and three fertigation levels {F1(100%), F2(80%), and F3(60%) recommended dose of fertilizer} under drip irrigation conditions for nutrient uptake, growth parameters and yield in guava plants. The experiments were set up in factorial randomized block design with eighteen treatment combinations. The experiments were conducted during the year 2012-13.

I. INTRODUCTION

Mulch is used to improve the fertility and health of a soil. It can also be used to reduce weed growth and enhance visual appeal of the area. Mulch is usually but not exclusively organic in nature. It may be permanent (plastic sheeting) or temporary (bark of trees and leaves). It may be applied to bare soil, or around existing plants. Mulches of manure or compost will be incorporated naturally into the soil by the activities of worm and other organism. Dorling4 reported that mulch process is used both in commercial crop production and in gardening and when applied correctly it improved soil fertility. Ruth reported that mulch is the gardener's greatest time saver; just make sure it does not monopolize all the nitrogen.9 Some mulch is tilled into the soil before planting a new crop and therefore may have an effect among soil fertility and soil chemistry.6 In the short term, mulches may decrease nitrogen availability of a given crop and may for a while negatively affect plant growth.6 A material that has high carbon content and is very low in nitrogen and other nutrient may "bind" or immobilize plant-available nitrogen temporarily. This occurs because soil microorganisms use available nitrogen to metabolize and decay the organic material. The immobilized organic nitrogen can be made available (mineralized) later as the organic matter continues to decompose. In order to maximize the benefits of mulch, while minimizing its negative influences, it is often applied in late raining/early dry season when soil temperature has risen sufficiently, but soil moisture content is still relatively high

II. LITERATURE REVIEW

Makoto kitou, et al In our study, no correlation was observed between the decomposition rate and the contents of carbohydrate components such as ethanol soluble, hot water soluble, hemi cellulose, cellulose, and lignin fractions. Only the total carbon content at 2 weeks after mulching was positively correlated with the decomposition rate in this experiment. Such a discrepancy in the correlation between Hirose's report and this experiment may be mainly due to the fact that the decomposition of plant residues placed on the soil surface was investigated in this experiment, unlike in Hirose's report. Among the plant residues, blackwattle residues showed a very low decomposition rate, although the total nitrogen content was high and the *CjN* ratio was low. The contents of ethanol- and hot water-soluble fractions were also high. As this plant contains a high level of tannin in its bark (Duke1981), the low decomposition rate of black wattle residues may be due to the inhibitory effect of tannin and decomposition products such as vanillin and vanillic acid (Higuchi and Kurihara 1980). [1]

Junaid N Khan Guava (P*sidium guajava*) is being cultivated on largeare as in India (Sharma, 2009) for its high adaptability to varied soil and climatic conditions. Guava fruit is often referred to as apple of tropics probably as it is the only fruit that matches the high nutritive value of more commercially important temperate fruit apple. From horticulture perspective it is one of the most common fruits grown commercially in India and is ranked next to mango, banana and citrus fruits in respect of area and production. The total area under guava in India is228,500 ha with the production of 2.61 million tons(NHB, 2012). Like any other crops, guava also requires16 essential elements, and the absence of one or more essential elements affects metabolic process in plant resulting in expression of deficiencies (Singh

and Singh,2007).The experiment was performed at the farmland of the Department of Soil and Water Engineering, at Punjab Agricultural University. The university is located in Ludhiana, Punjab state, Northwest India (30º 56′ N, 75º52′ E, 247 m above sea level). In Ludhiana, winters are cold and summers are extremely hot, average annual maximum and minimum temperature is about 29.8ºC and16.5ºC respectively. Annual precipitation mean for the last five years was about 434.1 mm, which is mainly concentrated from June to September. This region has atypical monsoon climate. The soil at the experimental field is sandy loam (clay 9.8%, silt 14.6% and sand76.7%) having field capacity of 19.21% and bulk density of 1.43 g cm-3.[2]

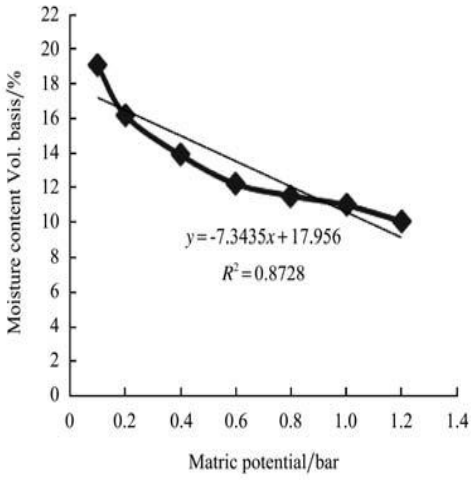

Fig 1 Soil moisture characteristic curve fortop layer (0-20 cm) of the soil

Quanqi Li, et al In North China, irrigation is required to obtain a high yield from winter wheat; these results in rapid aquifer depletion. The primary objective of this study was to investigate the influencing mechanisms of irrigation and straw mulching in preserving the soil moisture. Maize straw (3−5 cm) was mulched immediately after sowing winter wheat and irrigation water was supplied at 60 mm, controlled by using a flow meter, during the jointing, heading, or milking stages of the crop. The results revealed that irrigation decreased the eddy thermal diffusivity, sensible heat fl ux, and soil heat fl ux, but increased the latent heat fl ux. In contrast, straw mulching enhanced the eddy thermal diffusivity and sensible heat fl ux, but decreased the latent heat fl ux. Straw mulching increased the soil temperature at 5 cm depth form January to February, but decreased the soil temperature before January and after February. There were no significant differences in the total evapotranspiration between mulched and non-mulched treatments; however, there was a statistically significant difference in the evapotranspiration among the different growing seasons. Straw mulching reduced the evapotranspiration from the seeding stage to the regrowing stage, and the evapotranspiration with mulching was less than that non-mulching 47.4 mm. Further, straw mulching significantly reduced the number of spikes in the crop. Both irrigation and straw mulching increased the number of kernels, but had no visible effects on the thousand kernel weight. These results indicate that straw mulching may decrease the yield and water use efficiency (WUE) of winter wheat in North China.

With the increase in the air temperature, the soil temperature at a depth of 5 cm also increased (Fig. 2).However, compared to the effect of air temperature, the increase in soil temperature exhibited anhysteretic effects. The effect of straw mulching on the soil temperature has two sides: from January to February, the soil temperature was considerably higher in the mulched treatments than in the nonmulchedt reatments; however, before January and after February, the soil temperature was considerably lower in the mulched treatments than in the non-mulched treatments. This was mainly because the soil heat fl uxin the mulched treatments was considerably lower thanthat in the non-mulched treatments.[3]

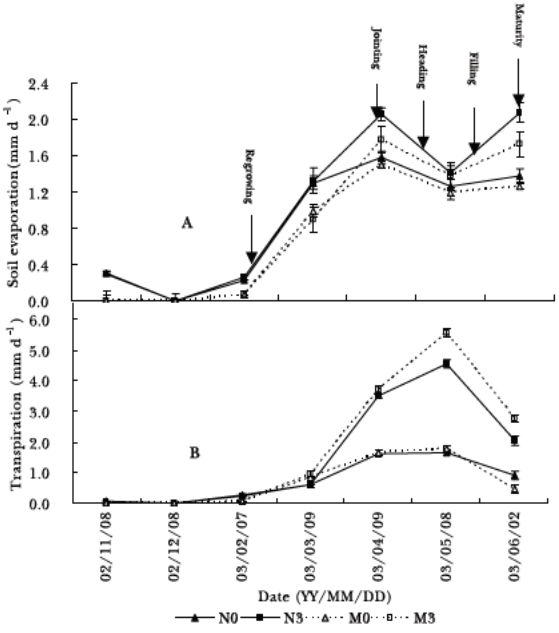

FIG 2 Soil evaporation (A) and transpiration (B) in the growing season of winter wheat.
Vertical bars are standard errors.

Mohammad Abdul Kader Soybean (*Glycine max*) is a high water-demand crop and grown under moderate temperature in Japan. To shield the yield from sweltering summer and to use precipitation for its development, choice of

proper mulching material(s) is pivotal. For ideal creation of the harvest, soil dampness and temperature routines just as water use proficiency (WUE) of the yield were explored under straw, grass, paper, plastic and uncovered soil (control) mulching under downpour bolstered condition at Gifu college ranch in Japan. The mulching medicines, contrasted with the control, brought down soil temperature by 2 °C at 5 cm profundity and 0.5 °C at 15 and 25 cm profundities. The plastic and straw mulching put away the most elevated amount of soil dampness at 5 and 15 cm profundities; the exposed soil put away the least amount. At 25 cm profundity, soil-dampness content was the most elevated under paper mulch yet constant under different mulches. Plastic mulching diminished vanishing rate from the dirt surface and, therefore, the decreased soil-water utilization (SWC) from the root zone enlarged WUE of soybean. The paper mulching, by monitoring soil-dampness and diminishing soil temperature, if better yield development qualities, while the plastic mulching improved WUE of green soybean. In this way, the plastic mulch performed best in decreasing soil-water utilization and expanding WUE, while the paper mulch was useful for soil-dampness protection and temperature modification that expanded soybean yield. The dirt dampness content in the soybean plots under the mulching medications fluctuated with precipitation and air temperature over the developing season, with the uncovered soil (no mulch) showing a more prominent fluctuation of soil-dampness content (Fig. 3). The dirt dampness content was the most extreme in July because of more noteworthy precipitation, yet diminished in August because of restricted precipitation and more noteworthy temperature. The day by day soil-dampness content at 5 cm profundity was the most extreme under plastic mulching and least in the exposed soil. [4]

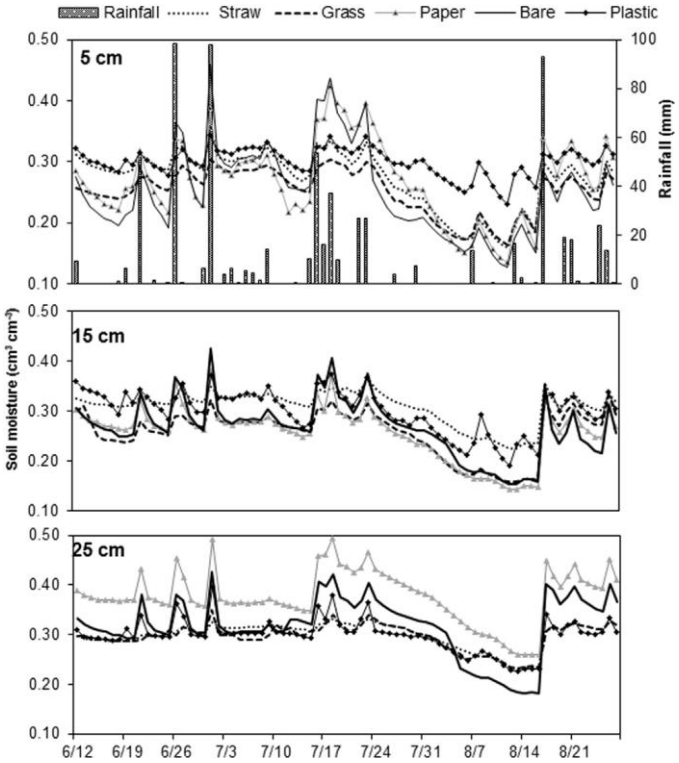

Fig. 3. Mean daily volumetric soil-moisture content at three depths (5, 15 and 25 cm) in the experimental soybean plots under various mulching treatments along with rainfall during the growing period.

Mark Ingman Plastic mulch is ordinarily utilized with smaller scale water system in created nations; be that as it may, Chinese ranchers utilize plastic mulch on an immense scale autonomous of smaller scale water system. For as far back as three decades, China's territory region in plastic mulch has surpassed the world's absolute land region in smaller scale water system. We report results from the water-rare locale of Minqin County, where 87% of Chinese ranchers met reacted that they utilize plastic mulch to monitor water and 53% to expand yields. Study results demonstrated the craving to monitor water using plastic mulch to be factually proportional to the longing to build yields. Reactions to interviews and studies demonstrate that ranchers see water investment funds of 24– 26% when plastic mulch is utilized. Meeting and overview reactions propose cultivating families are moving to buying wheat from outside the area; a potential import of "virtual water" into this water-rare district. Information from nine independent sources was collected and compiled to document the land area in China that has been cultivated through using plastic mulch since its introduction to China in the late 1970s. Since prior studies suggest that plastic mulch may be used in China as a water conservation strategy, we used data on the spatial extent of micro-irrigation (also known as dripirrigation) as a context for comparison with the spatialextent of plastic mulch use in China. The results of this

analysis are presented in Fig. 2.These results suggest that for over three decades China has cultivated more agricultural land with plasticmulch than all nations have cultivated through the useof micro-irrigation. Less than four percent of China's agricultural land uses micro-irrigation; therefore, the comparison presented in Fig. 4 includes a minimal amount of overlapping data (Jin and Young 2001, Denget al. 2006, World Bank 2006). [5]

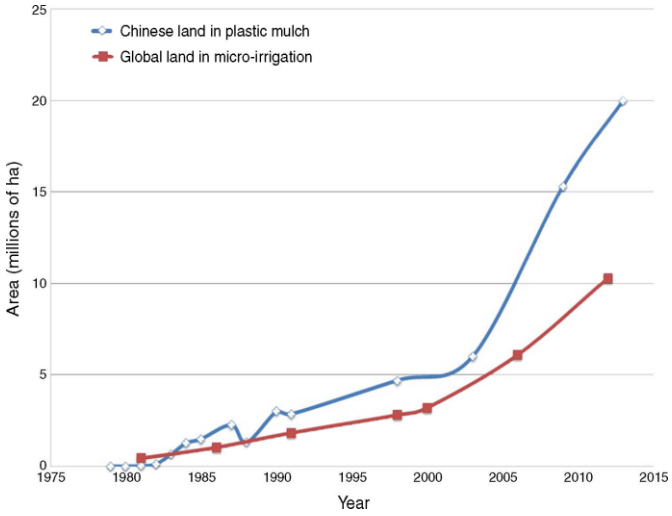

Fig 4 Total area of agricultural land in micro-irrigation globally as compared to the total area of agricultural land in China employing the use of plastic mulch (Wittwer et al. 1987, Ma 1988, Jensen and Malter 1995, Postel et al. 2001, Rosato 2004,Kulkarni et al. 2006, Chen et al. 2013, World watch Institute 2013, Dai and Dong 2014).

III. CONCLUSION

As we get to know through various research work and field visits that there are various types of mulch material, which helps in reducing evaporation losses and retaining soil moisture content based on their respective properties. Research work suggests that plastic mulch is best efficient mulch material to increase crop yield but at same time it is not so economical but we have come across various other biodegradable mulch such as rice straw, newspaper etc which also has promising future if few alterations are applied and used. So far based on various researches we have come up with never been used biodegradable mulch i.e. crop residuals/twigs which will be using as mulching material for cultivation of soybean crop. as we could obtain brief analysis of soybean crop under a new mulch material and could contribute in field of mulching.

REFRENCES

[1] Makoto kitou, et al, "Mlching effect of plant residue on soybean growth and soil chemical properties", soil science and plant nutrition, 2012.

[2] JunaidN.khan, et al, "Simulation of mulch and non-mulch condition for various soil matric potential thresholds for drip-Fertigated Guava", in the swmiarid region of Northwest India,

[3] Mark Ingman, et al, "Agricultural water conservation in China: plastic mulch and traditional irrigation", Ecosystem health and sustainability, 2017

[4] Quanqi Li, et al, "Effect of irrigation and straw mulching on microclimate characteristics and water use efficiency of winter wheat" in North China, 2015

[5] Mohammad abdulkader, et al, "Mulching – type induced soil moisture and temperature regimes and water use efficiency of soybean under rain fed conditions", in central Japan. 2016