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Response of maize to inter row mulch application at different growth stage of maize for small scale agro-pastoralist

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This experiment was conducted at yabello districts to study the effect of mulch application at different growth stage of maize (Mulch application at sowing, vegetative flowering and at grain filling stages). Mulch application at different growth stage of maize shows significant difference at all growth stage of maize. The highest and lowest grain yield were obtained from mulch applied at sowing time and no mulch applied at all growth respectively. The application of mulches at sowing stage gave a yield advantage of 66.4 and 52.48% of the farmers or no mulched plots in Borana lowland. The mulch application at sowing stages show significantly different from all the treatments except mulch application at vegetative growth stage. Any grass and straw can be used as mulching materials. The effectiveness of mulch application was depending on the moisture or rainfall availability during the time of mulch applications. Application of mulches also helps the farmers to avoid early establishment of weeds population so that it enhance the chance for maize to exploit the limited available moisture in moisture stress area of Borana lowlands.

Key words: Borana lowland, mulch application, , sowing time

INTRODUCTION

Maize (*Zea mays* L) is one of the most important cereal crops in Ethiopia, ranking second in area coverage and first in total production. About 40% of the total maize growing area is also located in low-moisture stress areas, where it contributes less than 20% to the total annual production. This is because; rainfall in this region is unpredictable (may start early or very late in the season) in terms distribution and amount (some times less than 600 mm/annum). Because of these food security is a likely problem in spite of population is increasing from day to day. This can be overcome by enhancing production of major crops. Among these measure, spreading plant residues or any other material like straw, grass or crop residue on the soil surface can used to reduce water evaporation losses is called mulching. Mulch is any material placed on the soil surface to conserve moisture, lower soil temperatures around plant roots, prevent erosion and reduce weed growth. Mulches can be derived from either organic or inorganic materials (Meyer *et al*., 1970; Smolikowski *et al*., 2001; Rumpel *et al*., 2003). Mulching does not perform instant miracles, but it encourages better plant growth and development.

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Keeping this in view, the present work was planned to study the response of maize to the application of mulch at different growth stage.

Materials and Methods

The study was conducted at Yabello Pastoral and Dry Land agricultural Research station, yabello district of Borana zone during the main cropping season of 2010 and 2011. A Randomized Complete Block Design (RCBD) with three replications consisting of five treatments made up of dry weed grass mulching material were used to conduct the experiment. The treatments were as the follows: Mulching at planting, vegetative, flowering, grain filling and Control.

Each plot measures 4.5 × 3 m with 1 m gap between each plot and 2 m between blocks. This gave a total of 15 plots with experimental area of 332.5 m^2. A plant spacing of 75cm × 25 cm was used.

Mulch application was done through covering the whole plot with no uncovered area of plot following every growing stage of maize. Melkassa 1 maize variety was used for the experiment. Malathion 50% was used to control the termite infestation during no rainy weeks

Results and Discussions

Plant Height (cm)

All treatments showed significant difference for plant height (Table 1). Among the treatments mulch applied at sowing time had the highest plant height of 138.33cm followed by mulch applied at the vegetative growth stages (table 1), while short statured was recorded from no mulched plot.

Ear Height (cm)

The variations in ear height (cm) in present investigations were found to be significant due to mulch applied at different growth stage. The highest and lowest ear length were obtain from the mulch applied at sowing time and no mulch.

Grain Yield (kg ha-1)

Data of grain yield are shown in Table 1. The total grain yield produced for mulch applied at planting stage and vegetative stages were statistically similar, Significant differences was obtain for grain yield among different mulch applied at different growth stage of maize for this study. Across the seasons, mulch applied at planting and vegetative produces more than two times the total grain yield obtainable from the unmulched plots, while the mulch applied at flowering and grain filling gives lower yield compared to the two growth stage of maize. The grain yield advantage of 66.4 % and 52.48 % were obtained from mulches applied at sowing time over the farmers' practice or no mulched plots. This may be attributed due to the ample amount soil of moisture available for crops for long time as compared mulch applied at flowering and grain filling stages and this time also coincide with the rainfall ending time of the seasons. The result also confirmed that the late application of mulch show little or no effect on the maize yield increments due to the dwindled moisture of the soil and rainfall amount in the season. And the effects of mulch application also influenced by availability of soil moisture when the mulch application was done. Mulches also promote crop development and early harvest, and increase yields. Very little weed growth occurs under the mulch as the mulches prevent penetration of light or exclude certain wavelengths of light that are needed for the weed seedlings to grow (Ossom et al., 2001).

Hundred Seed Weight (Hswt)

The Hswt shows that there was a significant difference among the mulches applied at different growth stage maize at ($P<0.05$) level. However, no significant difference was observed for mulches applied at planting time and vegetative growth stage of maize. These might be attributed due to the carrying over effect of stress appeared at one stages had a chance to influence on the other growth stages of maize and vice versa. The farmers practices or no mulched treatments gets low hundred seeds weight compared to mulched experiments at all. Therefore fore, small scale farmers of Borana lowland it is better to cover the whole plots by any weeds free materials, grasses and crop residues to increase the maize productivity around the homestead areas.

Numbers of Seeds per Cobs (NSC)

The results of these works shows that significant difference was obtained for mulch applied at different growth stages of maize. The earlier the mulches applied the higher the number of seeds per cobs obtained from the maize.

CONCLUSION AND RECOMMENDATIONS

Variations in semi-arid rainfall patterns also include delayed on-set and premature end of the rainy season. The rainfall often occurs as high intensity, short duration convective storms (Nonner, 1997) giving rise to severe soil erosion especially early in the cropping season when the ground is still bare in such are it is urgent to apply moisture conservation techniques to feeds people living in the rain fall marginalize areas.

Mulching application at planting and vegetative growth stage had significantly more grain yield and yield component than that of the other treatments investigated in the experiment (Table1).

Table 1: Mean of different maize parameters evaluated for mulch evaluation at different growth stages.

	2010						% in	2011						% yld inc
	DM	Pl	El	NSC	HSW	Yld		DM	Pl	El	NSC	TSW	Yld	
1	89.33[a]	138.33a	25.47a	38.6a	24.5a	36.47a	66.4	90.67a	126.5a	34.13a	43a	26a	40.4a	52.48
2	89.33a	136.40ae	22.53ae	36.3ae	23.24a	29.56ae	58.56	89.00a	126.6a	29.96a	41ae	25.6a	39.84ab	51.81
3	87.667ab	132.47be	21.77be	29.4bfg	21.89be	21.68beh	44.04	83.00bd	127.8a	36.35a	30bfi	22.20be	23.27cf	17.49
4	85.00bc	134.33ce	21.53ceg	26.65cfg	20.10cf	18.74cfh	34.63	83.50cd	124.8a	35.4a	28cgi	22.45ce	20.79df	7.87
5	76.33abc	132.20de	17.73df	25.05dfg	20.3df	12.25dgh	-	80.00cd	123.6a	38.4a	24dhi	19.56df	19.20ef	-
LSD (5%)	2.32	5.70	3.12	3.4	1.35	11.13		4.39	11.76	20.46	8.45	0.95	13.69	
CV	26.24	4.01	10.25	8.15	5.45	16.24		8.5	9.82	12.42	10	6.35	22.96	
Mean	22.54	142.12	21.34	11.614	22.09	22.54		89.06	34.85	34.85	12.9	23.16	37.84	

Trt 1=mulch application at sowing, 2= mulch application at vegetative stage, 3= mulch application at flowering 4=mulch application at grain filling 5=no mulch at all growth stage, DM= date to maturity, Pl= plant height, El= ear height, yld = yield, CV= coefficient of variation, LSD= least significant difference, HSW = Hundred seed weight, NSC= # of Seed per cob.

Mulching applied at planting time, shows noticeably prolonged days to maturity on maize in the two cycles of maize production in this work. Effectiveness of mulch application had direct relationship when mulch application was applied at high soil moisture content, unless the effect was not seen easily from that unmulched one. Because, in Borana lowland rainfall is very short, temperature is high and the soil is dry within a day, then mulch application can minimize the effect of moisture loss due to high temperature of the area and increase the chance for crop utilizations. The results of this experiment revealed the planting time was time to get maximum yield when the mulch applied at this stage. Mulching application at sowing and vegetative stage indicate significance in retaining soil moisture in moisture stress areas of Yabello and areas similar to yabello agro ecology. The advantage of the study is that can done using local available mulching materials (weeds grass and crop straw). In future these areas could be investigated: soil temperature, the thickness of the mulching material and include other mulching type. In moisture stress areas where soil moisture is limited and weed problem occur very at the beginning, this study could be of great help.

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