

GROWTH AND YIELD RESPONSE OF PEPPER TO MULCHING

Aiyelaagbe, I. O. O.
Department of Agronomy University of Ibadan

Fawusi, M. O. A.
Department of Agronomy University of Ibadan

<http://hdl.handle.net/2324/8121>

出版情報 : BIOTRONICS. 15, pp.25-29, 1986. Biotron Institute, Kyushu University
バージョン :
権利関係 :



GROWTH AND YIELD RESPONSE OF PEPPER TO MULCHING

I. O. O. AIYELAAGBE and M. O. A. FAWUSI

Department of Agronomy, University of Ibadan, Nigeria

(Received August 19, 1986; accepted September 16, 1986)

AIYELAAGBE I. O. O. and FAWUSI M. O. A. *Growth and yield response of pepper to mulching*. BIOTRONICS 15, 25-29, 1986 With a view to optimizing water use during dry season pepper production, sawdust, dry grass, and maize cob mulches were applied, and their effects compared with a no mulch control. Mulching significantly enhanced vegetative growth and fruit yield of pepper by retarding rate of soil moisture depletion and keeping soil temperature in the afternoons below supra-optimal levels. Mulch types differed significantly in their effects on some growth attributes but they did not differ significantly in their effects on yield attributes. Results obtained suggest that critical soil water potential for pepper is -0.2 bar, while soil temperature above 30°C is deleterious to normal growth and reproductive development of pepper.

Key words: *Capsicum annuum* L.; pepper; mulching; dry season; growth; yield.

INTRODUCTION

Pepper is an important spice vegetable among the peoples of the humid tropics (11). In Nigeria it is grown in both the wet and dry season but attracts a larger profit during the dry season when the demand is often in excess of the limited supplies. Pepper yield in the dry season is limited by soil moisture stress in spite of the maximum sunlight intensities which prevail (6). Full or supplementary irrigation could be used to alleviate the soil moisture stress, however, the high cost of irrigation water necessitates its economy. One way of achieving this is by mulching. Mulching has been used to obtain good yields in other crops (8, 9) by exploiting one or a combination of its properties (10). Thus this study was conducted to investigate the effects of dry season mulching on pepper growth and yield.

MATERIAL AND METHODS

Seven week old seedlings of pepper (*Capsicum annuum* L. cv Rodo) were transplanted 0.6×0.3 m unto a loamy sand during the dry season. Two weeks after transplanting, sawdust, maize cobs, and dry grass mulches were laid 2.5 cm thick following a Randomized Complete Block design. Application rates corresponded to 0.7, 7.0 and 2.0 kg/m^2 respectively. Tensiometers were sunk to 15 cm soil depth

to monitor soil water potential as from five weeks after transplanting. Field was watered to field capacity once a week.

Soil temperature at 15 cm depth was taken at 7.00 a.m., 2.00 p.m. and 6.00 p.m. using a YSI telethermometer Model 43TD attached to a soil probe. Degree of crust formation on soil surface was measured using a pocket penetrometer while weed intensity was assessed using visual scoring (4).

Fifteen plants per mulch type were tagged for non-destructive weekly measurements of plant height, canopy diameter, while six plants per mulch type were excavated for dry matter determination and leaf area measurements on a weekly basis. Fruits were harvested weekly as from the mature green stage using data plants surrounded by guard rows.

RESULTS AND DISCUSSION

Soil factors

Figure 1 shows the time course of soil water potential. Mulched plots maintained a high soil water potential regime of -0.20 bar during the watering cycles whereas on bare (unmulched) plots, soil moisture was rapidly depleted to -0.64 bar soil water potential. Although mulching did not significantly affect morning temperatures of the soil, in the afternoon the rate of rise in soil temperature was retarded by the mulches so that maximum soil temperatures on mulched plots were significantly lower than on bare plots (Fig. 2) (10). The former effect was achieved by preventing direct contact of soil with dry air, while in the latter it was by interception of the sunlight rays by the boundary layer formed by the mulches.

Whereas mulch application significantly increased soil penetrance (Table 1) thereby increasing water infiltration, the hard crust formed on the bare soil surface due to the alternating wetting and drying cycles decreased soil penetrance thereby predisposing the soil to run-off.

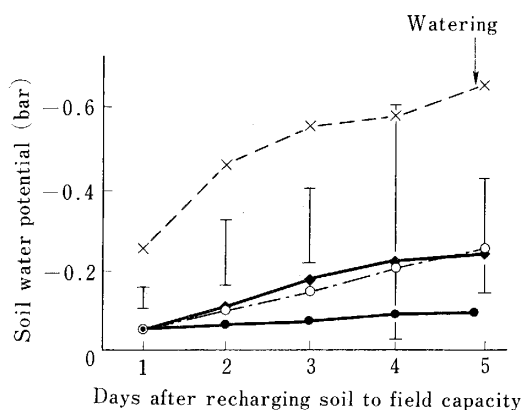


Fig. 1. Time course of soil water potential in plots with no mulch (x), sawdust mulch (●), maize cob mulch (○) and dry grass mulch (◆). I LSD.

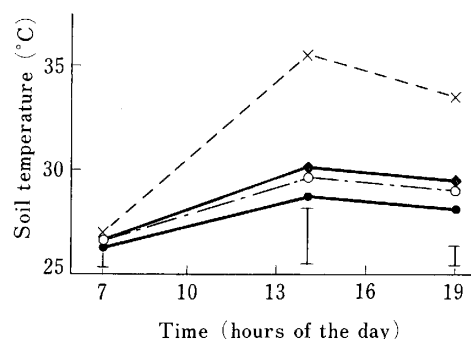


Fig. 2. Variations in soil temperature of plots with no mulch (x), sawdust mulch (●), maize cob mulch (○) and dry grass mulch (◆). I LSD.

Table 1. Effect of mulching on soil penetrance, weed intensity and growth attributes of pepper plants

	Plant height (cm/plant)	Canopy diameter (cm/plant)	Leaf area (cm ² /plant)	Total dry weight (g/plant)	N content (%)	Soil penetrance (kg/cm ²)	Weed intensity (score)
No mulch	14.91	94.67	164.16	3.21	1.34	3.19	2
Sawdust	24.88	178.83	807.75	14.51	0.52	2.00	1
Dry grass	26.19	205.67	420.23	10.86	0.65	1.87	3
Maize cobs	22.93	167.17	1244.19	16.97	0.39	1.96	2
L.S.D.	3.24	21.83	216.12	3.53	NS	—	—

Sawdust controlled weeds better than dry grass and maize cob mulches (Table 1) because being more finely divided than others it ensured better coverage of the soil surface thereby preventing germination of weed seeds or smothering the germinated weed seedlings.

Mulched pepper plants were significantly larger than unmulched plants (Table 1) because high soil water potential was maintained thus encouraging optimal transpiration, nutrient uptake and photosynthesis rates (3).

The high soil temperature regime of 35.5°C in unmulched plots must have retarded root growth and impaired water uptake, nutrient uptake and photosynthesis required for plant growth; these must have culminated in the stunted plant sizes (Table 1). Thus the soil temperature value of 35.5°C was considered supra-optimal for pepper.

The plants did not differ significantly in their nitrogen content thus suggesting that at the rate of application and for the duration of the study (21 weeks) sawdust did not significantly immobilize soil nitrogen as often reported in literature (1). The relatively high nitrogen content in leaves of unmulched plants may be due to accumulation of NO₃ nitrogen in the leaves due to plant water deficits. Such has been observed in bananas (5).

Yield

Fruit yields during the first three weeks of fruit production did not differ significantly. However, during the fourth week of fruiting (fifteen weeks after mulch application) mulched plants significantly outyielded unmulched plants (Fig. 3) because unmulched plants produced fewer flowers most of which abscised due to soil moisture stress (7). Figure 4 shows that total fruit yield of mulched plants did not differ significantly ($P=0.05$), however, total fruit yields of the mulched were significantly higher than fruit yield from unmulched plots.

The decline in fruit yield 15 weeks after mulch application occurred due to severe soil moisture stress resulting from the inability to continue the watering schedule indicated in Fig. 1. This was because the taps went dry. The unmulched plants were less affected because they had developed deeper roots which were able to extract water from the lower soil profiles; however in mulched plants most of the roots developed near the soil surface (2) which was progressively depleted by soil moisture as the dry spell extended for more than one week. The decline in fruit

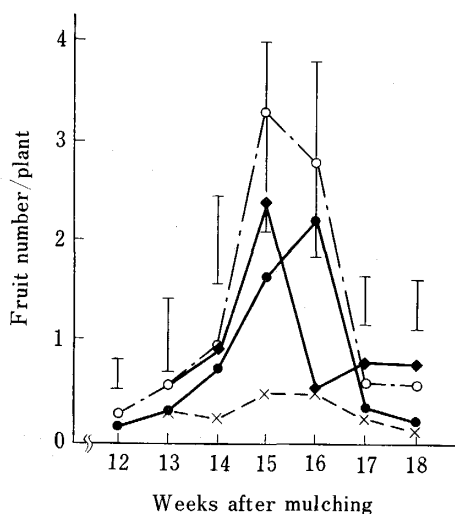


Fig. 3. Time course of fruiting in pepper plants with no mulch (×) sawdust mulch (●), maize cob mulch (○) and dry grass mulch (◆). I LSD.

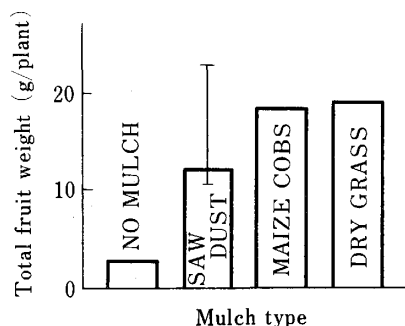


Fig. 4. Total fruit yield of pepper plants in unmulched and mulched plots. I LSD.

production shows that mulching has to be supplemented with irrigation to maintain optimum yields of pepper during the dry season.

The results of this study show that in unmulched plots daily watering will be required to maintain the critical soil water potential of -0.2 bar, whereas on mulched plots watering once a week achieves the same effect. It also showed that the absence of mulch cover could reduce dry season pepper yield potential by 85%. The mulch materials appear equally effective and could be used as substitutes should the need arise. However, the yield differences between the sawdust and the maize cob or dry grass mulch plots though not statistically significant are large enough to make maize cob and dry grass preferable to pepper growers.

REFERENCES

1. Bollen W. B. (1953) as quoted by Allison, F. E. (1973) Pages 500-517 in *Developments in Soil Science. Vol. 3.* Elsevier, Amsterdam.
2. Cassidy D. S. M. and Kumar D. (1984) Root distribution of *Coffea arabica* L. in Zimbabwe. I. Effect of plant density, mulch cover planting and shade in Chipinge. *Zimbabwe J. Agric. Res.* **22** (2), 119-131.
3. Cho T., Eguchi H., Kuroda M., Tanaka A., Kontaki M., Ng A. L. and Matsui T. (1985) Effect of soil water potential on transpiration rate in cucumber plants. *Biotronics* **14**, 1-6.
4. Drinjiff A. H. and Kerkhoveng J. (1979) Effect of efficient weeding on yields of irrigated cotton in Eastern Kenya. *PANS* **16** (14), 596-605.
5. Krishanan B. M. and Shanmugavelu K. G. (1980) Studies in water requirements of Banana cv Robusta. III Leaf nutrient concentration and uptake of nutrients. *Mysore J. Agric. Sci.* **14** (2), 215-223.
6. Nwa E. U. (1975) Irrigation, drainage and systems of water management for horticulture. Pages 106-121 in O. O. Ojehomon, P. A. Town and K. McLean (eds) *Proceedings of 1st National Seminar on Fruits and Vegetables.* Caxton Press, Ibadan.
7. Olanrewaju J. D. (1981) Effect of water stress on flower and fruit set of sweet pepper (*Capsicum*

- annum* L.). Page 36 in *Book of Abstracts VIth African Horticultural Symposium 19th–25th July, 1981*. Conference Centre, Ibadan.
8. Patterson D. R., Speights D. E. and Larson J. E. (1970) Some effects of soil moisture and various mulch treatments on growth and metabolism of sweet potato roots. *J. Amer. Soc. Hort. Sci.* **95**, 42–45.
 9. Quinn J. G. (1975) A further assessment of mulching and staking on a rainfed tomato crop on Northern Nigerian Soils. *Hortic. Res.* **15**, 31–39.
 10. Tissen H (1978) Polyethylene mulches in vegetables production. *Min. of Agric. and Food Ontario Fact Sheet* **78**, 008.
 11. Van Epenhuijsen C. W. (1974) *Growing Native Vegetables in Nigeria*. Page 44, FAO, Rome.