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EFFECT OF SOIL MOISTURE CONSERVATION TECHNIQUES AND LEVELS OF IRRIGATION ON SOIL MOISTURE RETENTION AND YIELD OF ORIENTAL PICKLING MELON

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ABSTRACT

A field experiment was conducted in the summer rice fallows at the Agricultural Research Station, Mannuthy, Kerala, during 1996 to study the effect of moisture conservation techniques and levels of irrigation on the soil moisture retention and yield of oriental pickling melon. The study revealed that incorporation of coir pith, saw dust and paddy waste increased the soil moisture content over control 10.9, 1.6 and 7.1 per cent and field WUE by 9.9, 5.3 and 19.9 per cent respectively. Consumptive use was also increased by the moisture conservation techniques. Levels of irrigation showed a negative relation with WUE and positive relation with consumptive use. The peak consumptive use and crop coefficient coincided with the fullest development of canopy and flowering stage of the crop. The crop depleted about 50 per cent of soil water from the top 15 cm layer. The crop needed frequent irrigations as dictated by IW/CPE ratio 1.2 for maximum yield. Incorporation of moisture conservation materials substantially increased the yield of cucumber. The increase in the yield by the addition of paddy waste, coir pith and sawdust over control was 27, 17 and 10 per cent respectively. Incorporation of moisture conservation materials can save five number of irrigations required by the crop.

KEY WORDS : Moisture conservation techniques, IW/CPE ratio, consumptive use, water use efficiency, yield

Growing vegetables in the summer rice fallows is a common practice. In the summer rice fallows, vegetables are exclusively growth with irrigation. The cost of vegetable production in the summer is very high due to the requirement of too frequent irrigations. Water use efficiency of summer vegetables is also very less due to enormous loss of water through evaporation, seepage and deep percolation. Therefore, attempts were made to develop a suitable water management practice for summer vegetables which eliminate the necessity for frequent irrigations by integrating with viable soil moisture conservation techniques. As cucurbits form a major part of vegetable grown in the summer rice fallows oriental pickling melon was selected for such a study.

MATERIALS AND METHODS

The experiment was conducted at the Agricultural Research station, Mannuthy, Trichur, Kerala during January to May 1996. The soil of the experimental field was sandy clay loam with bulk density 1.34 g cm^{-3}, acidic in reaction with a pH of 5.4, field capacity 19.08 and permanent wilting point 10.82. The weather during the cropping period was almost normal with an average daily pan evaporation 6.4 mm day^{-1}. A total rainfall of 220.2 mm was received during the experimental period coinciding with the fruit maturity stage.

The experiment was laid out in a randomised block design with three replications. There were 16

Table 1. Details of the irrigation treatments

Treatments	Total number of irrigation	Interval of irrigation (days)	Quantity of water applied (mm)	Pre-treatment irrigation (mm)	Effective rainfall (mm)	Total quantity of water applied (mm)
I_1	4	12-17	132	91.0	59.5	282.5
I_2	8	6-9	264	91.0	110.0	465.0
I_3	13	4-6	429	91.0	127.7	647.7
I_4	3	-	99	91.0	93.0	283.0

Table 2. Mean soil moisture content (% w/w) of soil and fruit yield of crop under different moisture conservaion techniques (MCT) andlevels of irrigation

Treatments		Mean Soil moisture content		Yield (t ha^{-1})
		BI	AI	
MCT				
	S_0	9.18	14.67	28.432
	S_1	9.94	14.90	31.395
	S_2	9.98	15.71	36.015
	S_3	10.02	16.25	33.168
Irrigation				
	I_1	8.85	14.27	25.336
	I_2	10.85	16.03	34.432
	I_3	11.55	16.65	47.208
	I_4	8.00	14.66	22.035
SEM ()		-	-	1.299
CD	(P=0.05)	-	-	3.751
Interaction		-	-	7.501

AI : 48 hours after irrigation, BI : Before irrigation

treatments consisting of combinations of 4 moisture conservation techniques *viz.*, control (S_0), incorporation of sawdust (S_1), paddy waste (S_2) and coir pith (S_3 @ 1/3rd pit volume and 4 levels of irrigation *viz.*, irrigation at IW/CPE ratio of 0.4 (I_1), 0.8 (I_2), 1.2 (I_3) and at the critical stages of branching, flowering and fruit development (I_4). The details of the irrigation treatments are given in Table 1. Methods of irrigation adopted was pot watering. The oriental pickling melon variety Mudikkode local was used for this study. The crop was planted at a spacing of 2 x 1.5 m. Soil samples were taken from three depths viz. 0-15 cm, 15-30 cm and 30-45 cm before irrigation and 48 hours after irrigation for soil moisture studies.

RESULTS AND DISCUSSION

Soil moisture content : Higher soil moisture contents were observed in all the plots both before as well as after irrigation which received moisture conservation materials (Table 2). The percentage increase in the after irrigation moisture contents averaged over the irrigations with coir pith, paddy waste and sawdust were in the order of 10.9, 7.1 and 1.6 over control. Similar increases in the before irrigation moisture contents with the above materials were 9.2, 8.7 and 7.3 respectively. Among the moisture conservation materials, coir pith retained the maximum moisture followed by paddy waste. These results agree with the findings of Raghothama (1981) who found that coir pith and

Table 3. Mean seasonal consumptive use (Cu), crop coefficient (Kc) and water use efficiency (WUE) as influenced by moisture conservation techniques (MCT) and levels of irrigation

Treatments	Cu (mm)	Kc	WUE (kg ha mm^{-1})	
			Crop	Field
MCT				
S_0	330.50	0.53	89.90	72.30
S_1	346.50	0.57	91.10	76.10
S_2	339.50	0.55	105.10	86.70
S_3	354.50	0.58	91.40	79.50
Irrigation				
I_1	265.40	0.45	95.50	77.70
I_2	382.90	0.63	91.00	74.00
I_3	498.60	0.80	90.30	74.00
I_4	224.10	0.40	98.50	78.00

Table 4. Mean daily consumptive use in mm day^{-1} (Cu) and crop coefficient (Kc) at different periods of crop growth

Treatments	20-35 DAS		36-50 DAS		51-65 DAS		66-80 DAS		81-97 DAS	
	Cu	Kc	Cu	Kc	Cu	Kc	Cu	Kc	Cu	Kc
I_1	3.28	0.49	3.48	0.47	2.11	0.34	2.08	0.35	2.43	0.48
I_2	4.01	0.60	5.39	0.73	5.1	0.83	2.77	0.48	2.64	0.57
I_3	6.31	0.94	7.30	0.99	7.12	1.16	4.29	0.74	2.44	0.52
I_4	3.62	0.54	2.39	0.36	2.10	0.34	2.39	0.33	2.37	0.51

paddy husk were the most effective materials for conserving soil moisture and reducing the number of irrigations required for cardamom. Soil moisture content was maximum with the frequently irrigated plots (IW/CPE) ratio 1.2) both before9re and after irrigation.

Consumptive use

Incorporation of moisture conservation materials increased the consumptive use (Cu) of water by the crop compared to control (Table 3). Comsumptive use was maximum in the treatment which receive coir pith (354.6 mm) followed by sawdust (356.5 mm) and paddy waste (339.5 mm). The lowest Cu was recorded by the control (330.5 mm). The increases in the consumptive use due to the addition of coir pith, sawdust and paddy waste over control were 24 mm, 16 mm and 9 mm respectively. This might be due to the higher moisture retention by these materials and subsequently a better expression of growth attributes observed in these treatments.

The Cu increased with increase in the frequency of irrigation. The highest value of 498.6 mm was recorded by frequent irrigation at IW/CPE ratio 1.2 followed by irrigation at IW/CPE ratio 0.8.

Table 5. Relative moisture depletion pattern from different soil layers in percentage as influenced by MCT and levels of irrigation

Treatments	Relative soil moisture depletion (%)		
	0-15 cm	15-30 cm	30-45 cm
MCT			
S_1	53.50	24.58	21.90
S_2	50.85	23.80	25.32
S_3	52.07	23.56	24.37
S_4	53.89	22.95	23.17
rrigation			
I_1	47.55	25.26	27.20
I_2	49.97	24.02	26.01
I_3	51.58	23.62	24.72
I_4	46.54	25.35	28.11

Frequent moisture supply created more favourable soil moisture supply created more favourable soil moisture regime conducive for better crop growth which enhanced the Cu by the crop. This is in conformity with the findings of Tomitaka (1974), Desai and Patil (1984) who also observed similar trends in cucumbers and watermelon respectively.

The mean daily Cu at various growth stages revealed that the peak Cu reached its maximum between 36-50 DAS for irrigation at IW/CPE ratio 0.4, 0.8 and 1.2. But for irrigation at the critical growth stages the peak Cu was observed between 20-35 DAS (Table 4). Thus the peak Cu coincides with the fullest development of canopy and the flowering stage of the crop. These results also agree with the findings of Cselotel and Varga (1973) and Loomis and Crandall (1977) who also observed that the Cu of cucumbers reached the peak during the flowering and early fruiting stages. At all the stages of growth, the mean daily Cu of the crop was the maximum when cucumber was irrigated at the IW/CPE ratio of 1.2 followed by irrigation at IW/CPE ratio of 0.8.

Crop coefficient

The crop coefficient values (Kc) averaged over the intervals showed an increase by the addition of moisture conservation materials (Table 3). Incorporation of coir pith recorded the highest Kc (0.58) value followed by that of sawdust (0.57).

The Kc values increased with increasing the levels of irrigation. Maximum Kc value (0.8) was recorded by irrigation at IW/CPE ratio 1.2 followed by that of 0.8 (0.63). This might be due the similar increase in the consumptive use with increase in the frequency of irrigation. The variation in the crop coefficient with different growth stages was due to the corresponding changes in Cu. Maximum Kc value was observed between 51-65 DAS for irrigation at IW/CPE ratio 1.2 and 0.8 and for other

Table 6. Interaction effect of moisture conservation techniques and levels of irrigation on yield (t ha^{-1})

Treatments	I_1	I2	I_3	I_4
S_0	24.905	27.905	37.570	23.350
S_1	23.350	35.126	44.902	20.942
S_2	26.368	39.033	54.513	24.146
S_3	26.460	34.663	51.846	19.702
SEM ()	2.597			
CD (P=0.05)	7.501			

irrigation treatments it was between 20-35 DAS (Table 4). Later it declined. Similar trend was observed by Loomis and Crandall (1977) in cucumber and Radha (1985) in pumpkin, ashgourd and oriental pickling melon. The subsequent decline in Kc values would probably be due to the reduction in crop canopy as the crop was at its senescence stage.

Water use efficiency

The moisture conservation techniques had a remarkable influence on water use efficiency (WUE) (Table 3). Moisture conservation with paddy waste had more crop and field WUE (105.14 kg ha mm^{-1} and 86.69 kg ha mm^{-1}) followed by that of coir pith and sawdust. The increase in the field WUE due to the addition of paddy waste, coir pith and sawdust were 19.9, 9.9 and 5.3 per cent respectively over control and for crop WUE these figures were 17.2, 1.9 and 1.5 per cent respectively. The increase in the WUE by the addition of moisture conservation materials was reported by Kalaghatagi *et al.* (1990) in maize and Suwwan and Judah (1985) in tomato.

The WUE was found decreasing with increasing levels of irrigation. Irrigation at critical stages registered the highest field and crop WUE (98.5 and 95.5 kg ha mm^{-1}) followed by irrigation at IW/CPE ratio 0.4. These finding corroborate the reports of Thampatti *et al.* (1993) in bittergourd and Radha (1985) in pumpkin, ashgourd and oriental pickling melon.

Soil moisture depletion pattern

Irrespective of the treatments, the upper most soil layer depleted maximum soil moisture (Table 5, Fig.1). On an average the crop deplected about 50 per cent soil moisture from top (0-15 cm) layer. The moisture depletion pattern from the 15-30 and 30-45 cm layers were almost identical and ranged from 21.9 to 28.11 per cent. The decreased moisture depletion with depth might be due to the fact that besides transpiration, losses from the soil surface were considerable and also the roots of the crop were mostly confined to the top surface layer. Another trend observed was that drier regimes of irrigation extracted more water from the lower soil layers (30-45 cm) when compared to wet regimes, possibly due to the extensive proliferation of root system to utilise soil moisture from deeper layers. Similar observations were reported by Loomis and Crandall (1977) in cucumber, Thampatti *et al.* (1993) in bittergourd and Radha (1985) in pumpkin, ashgourd and oriental pickling melon.

The moisture depletion from 0-15 and 15-30 cm layers was more or less similar for the moisture conservation techniques. But a slight increase in moisture depletion was observed from 30-45 cm when moisture conservation materials were incorporated. This increase over control was 3.42, 2.47 and 1.27 per cent for sawdust, coir pith and paddy waste respectively. This might be due to the loosening of soil by the incorporation of moisture conservation materials an thereby proliferation of more roots in the deeper layer.

Fruit yield

All the moisture conservation materials increased the fruit yield (Table 2). However significant increase over control was observed only in the case of paddy waste and coir pith incorporation. Highest yield (36.015 t ha^{-1}) was recorded by paddy waste incorporation. The yield increase due to the addition of paddy waste, coir pith and sawdust over control was 27, 17 and 10 per cent respectively. The increased yield by the addition of such materials were reported by Mavrodii (1979) in cucumber, Saravanababu (1994) in brinjal.

Levels of irrigation had a better influence of fruit yield (Table 2). Irrigation schedule at IW/CPE ratio 1.2 gave significantly the highest yield (47.208 t ha^{-1}). Though the yield from irrigation at IW/CPE ratio 0.4 (25.336 t ha^{-1}) and at critical stages (22.035 t ha^{-1}) were at par, they were significantly inferior to that of irrigation at IW/CPE

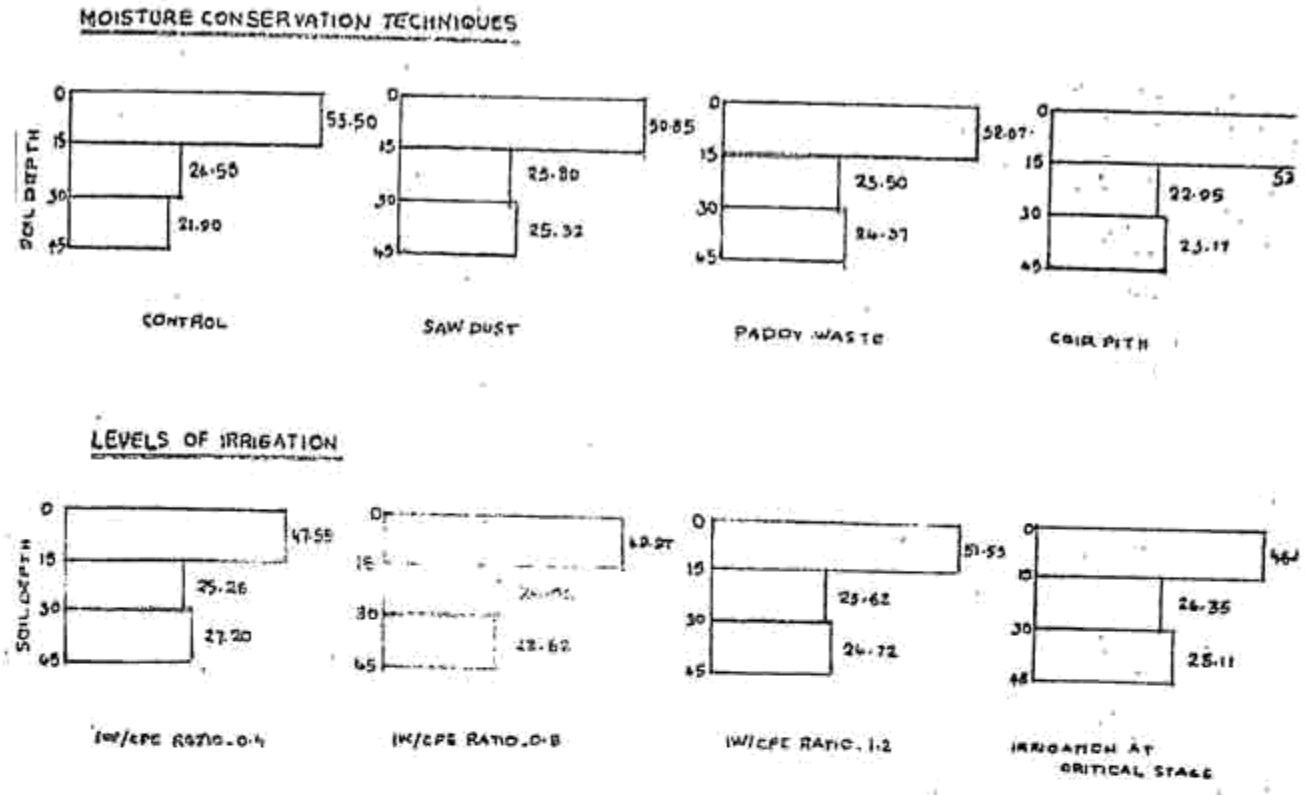

Fig.1. Soil Moisture Extraction Pattern (Values in percent)as influenced by Moisture conservation Techniques and Levels of irrigation

ratio 0.8 and 1.2. The increase in yield by irrigation at IW/CPE ratio 1.2 over that of 0.8, 0.4 and at critical stages were 37, 86 and 114 per cent respectively. This clearly indicates the necessity for frequent irrigations for maximum yield. This is in confirmity with the findings of Loomis and Crandall (1977), Desai and Patil (1984) Radha (1985), Prabhakar and Naik (1993) who have found that cucurbitaceous crops require frequent irrigation for maximum yield.

The interaction effect between moisture conservation techniques and irrigation was highly significant (Table 6). Incorporation of paddy waste recorded significantly higher yield over control when irrigation was given both at IW/CPE ratio 0.8 and 1.2. This increase over control was 45 and 40 percent respectively. The effect of coir pith was superior to control only when irrigation was given at IW/CPE ratio 1.2. The best combination was incorporation of paddy waste with irrigation scheduling at IW/CPE ratio 1.2.

From this study it is clear that for higher yield Oriental pickling melon needs frequent irrigations at the rate of once in 4-6 days (IW/CPE ratio 1.2). Nevertheless the yield from irrigation at IW/CPE ratio 1.2 (13 irrigations) without any moisture conservation was at par with that of irrigation at IW/CPE ratio 0.8 (once in 6-9 days interval - 8 irrigations) with moisture conservation materials. This clearly shows that moisture conservation materials can save five numbers of irrigation required for the crop.

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EFFECT OF PACLOBUTRAZOL IN CONJUNCTION WITH HERBICIDE ANILOFOS ON AGED SEEDLINGS OF RICE

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ABSTRACT

Field experiments were conducted during *rabi* 1993-94 and *Kharif* 1994 to find out the effect of growth retardant paclobutrazol in conjunction with herbicide anilofos on aged seelings of rice. The highest grain yield was obtained with the application of paclobutrazol 200 g/ha at 8 days after sowing in the nursery and anilofos 0.4 kg/ha at 5 days after transplanting followed by paclobutrazol 200 g/ha at 8 days after transplanting in the main field. Paclobutrazol applied at 8 days after transplanting was preferred to 15 days before heading.

KEY WORDS : Seedling age, paclobutrazol, anilofos, growth retardant

Normally 25-35 days old seedlings are recommended for transplanted rice. However, under delayed water supply, farmers are forced to extend the age of the nursery. Age of seedling at the time of transplanting is an important factor for uniform stand and establishment of rice (Padalia, 1981). As the planting was delayed, the yield components and grain yield decreased significantly. Therefore, a study was undertaken to find out the efficiency of paclobutrazol in conditioning the rice seedlings for delayed transplanting. The beneficial response of paclobutrazol in conjunction with herbicide anilofos was also studied.

MATERIALS AND METHODS

Field experiments were conducted in the wet lands of Tamil Nadu Agricultural University, Coimbatore during 1993-94 to evaluate the efficiency of paclobutrazol and anilofos on aged seedlings of transplanted rice.

The experiment was started in *rabi* 1993-94 in factorial design using 45 day old seelings. The nursery had 3 treatments *viz.*, 200 g/ha of growth regulator (paclobutrazol) at 8 days after sowing (DAS), anilofos 0.2 kg/ha followed by paclobutrazol 200 g/ha at 8 DAS besides the untreated check (control). In the main field, besides