system in ca[illegible]n region of Tamil Nadu. **Indian J. Agron.**, 35 : [illegible]

LOGANATHA, P. (1989). **Mushroom Cultivation as a Component in Mixed Farming System in Thanjavur District.** M.Sc. (Ag.) Thesis, Coimbatore.

MAHAPATRA, I.C. and GUPTA, S.C. (1992). Farming systems research. Challenges and opportunities. **In: Proc. XII National Symposium on Resource Management for Sustained Crop Production** Indian Society of Agronomy, Bikaner, 25-28 Feb. 1992, pp. 382-390.

RANGASAMY, A. and JAYANTHI, C. (1994). Recycling of organic wastes in integrated farming systems. **In: Proc. National Training on Organic Farming.** GOI & Tamil Nadu Agricultural University, Coimbatore, 1-8 Sep., 1994., pp. 114-118.

RANGASAMY, A., SHANMUGASUNDARAM, V.S., SANKARAN, S. and SUBBARAYALU, M. (1990). Integrated farming system management : A viable approach. [illegible] Bulletin, [illegible] Agricultural University, [illegible].

RANGASAMY, A., VENKITASAMY, R., PRIYASEKAR, M., and PALANIAPPAN, SP. (1992). Sustainable agriculture for rice based ecosystem. **Indian J. Agron.**, 37 : 215-219.

RANGASAMY, A., VENKITASAMY, R., PRIYASEKAR, M., JAYANTHI, C., PURUSHOTHAMAN, S. and PALANIAPPAN, SP. (1995). Integrated farming system for rice based ecosystem. **Madras Agric. J.**, 82 : 287-290.

SIVARAJ, S. (1989). **Economics of Poultry and Fish Culture as a Component in the Farming Systems under Thanjavur District Condition.** M.Sc. (Ag.) Thesis, Agricultural University, Coimbatore.

THROVE, P.V. and GALGOLIKAR, V.D. (1985). Economics of diversification of farming with dairy enterprise. **Indian J. Agric. Econ.**, 11 : 7-17.

(Received : October 1996 Revised : February 1997).

Madras Agric. J., 84(8) : 504-508 August 1997
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SURGE IRRIGATION STUDIES IN SUNFLOWER

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ABSTRACT

Surge irrigation was compared with continuous flow method of irrigation to find out the crop response, irrigation water requirement and water saving in sunflower crop. Sunflower hybrid MSFH 8 was grown in double row spacing of 120/2x30 cm (60 x 30 cm). There was no significant difference in yield between surge and continuous flow. However, there was 19.6 and 54.7 per cent saving of water in surge irrigation as compared to continuous flow and conventional farmers method respectively. It is due to the reduction in water front advance time in surge method particularly during the initial irrigation.

KEY WORDS : Surge flow, continuous flow, water front advance and recession

Sunflower is one of the important oilseed crops and often grown as rainfed crop. With the introduction of hybrids, it is imperative to go in for irrigation to maximise the production. A new method of irrigation, viz., surge irrigation of delivering water in long furrows, with a series of 'ON' and 'OFF' modes with uniform time spans, was tested with the following objectives:

a) to find out the irrigation water requirement in surge compared to continuous flow for sunflower b) to study the response of sunflower to surge irrigation and c) to study the moisture distribution pattern.

MATERIAL AND METHODS

A replicated trial was carried out in black soil (FC-24%, WP-12%, BD-1.45 Mgm^{-3}) at the Tamilnadu Agricultural University, Coimbatore during July, [illegible] to study the effect of surge and continuous [illegible] in 150 m long rows with a surge cycle of 1.5 (10 minutes ON and 10 minutes OFF) [illegible] in sunflower (MSFH. 8). Sunflower [illegible] 25 [illegible] both sides of the ridge [illegible] row pl[illegible] without altering the inter row [illegible] The [illegible] e distance was 120 cm at [illegible] and at [illegible] and it was 60 cm between [illegible] rows accommodating rows on both sides [illegible] s with [illegible] m spacing in the row [illegible] cm). In [illegible] PVC 50 cm length with 7.5 cm diameter [illegible] provided at the head with [illegible] for easy [illegible] adopting Bulgarian [illegible] technique [illegible] al. 1992). Considering [illegible] of 0.5, [illegible] flow rate of 1.5 lps was [illegible] Irriga[illegible] heduled at (IW/CPE [illegible] ning [illegible] depth) all vegetative [illegible] During [illegible] ive phase irrigation w[illegible]d at IW/[illegible] 1.75 taking the actual [illegible] irrigation [illegible] that could be

Table 1. Timer versus distance covered in continuous/surge flow

	Distance in m.			
	Initial stage (1 to 3 irrigation)		Later stage (4 to 7) irrigation	
	Continuous (Advance)	Surge (Advance + Recession)	Continuous (Advance)	Surge (Advance + Recession)
10	45	75	55	60
20	84	123	105	128
30	108	131	119	146
40	123	150	144	150
50	130		150 (45 Min.)	(35 Min.)
60	150			

Table 2. Quantity of water applied and per cent saving

Method	Irrigation water depth (cm)	Saving as compared to farmers method (%)	Saving in surge compared to cont. flow (%)
* Farmers method (Projected)	35 (7)		
After accounting for efficincey 85%	41.18		
Continuous flow	23.20 (10)	43.7	-
Surge flow	18.65 (10)	54.7	19.6

* Estimated at 5 cm per irrigation for 7 irrigations. Due consideration was given for application efficiency of 85 per cent. Figures in the parantheses are number of irrigations.

applied by surge (IW = 2.5 cm). Soil samples were taken one day after irrigation pattern till next irrigation. All the observation (both biometric and soil moisture) were taken for every 25 m length. The plot was maintained weed free throughout the crop period.

RESULTS AND DISCUSSIONS

Irrigation and the quantity of water

Continuous flow took more time of 60 minutes to cover 150 m length compared to the surge flow where it took only 40 min. at the constant flow rate of 1.5 lps. (Fig.1) This time variation of 20 min. was found for initial irrigations only (Table 1). However, for the subsequent irrigation i.e. 4 to 7th irrigation, the time period was cut short to 45 min. and 35 min. in continuous and surge flow respectively. It may be due to increase in bulk density of the soil. This time difference has further come down for the subsequent irrigations and it was almost same in both the methods to cover 150 m length of furrows. According to Humpherys (1989) the surge irrigation has its greatest effect during the first irrigation of the season till the soil bulk density was low. The result obtained in the present investigation also indicated the same trend. Thus, there was saving of water in surge irrigation due to the early advancement of water front to the tail end (20 min.) which in turn is due to the reduction in infiltration of water due to surface consolidation, filling of cracks which formed in the furrow bed and air entrapment.

Quantity of irrigation water applied and the amount of water saved over the crop period in continuous/surge flow compared to the projected farmers method of irrigation is reported in Table 2.

Brown *et al.*, (1988) observed that a thin coating of fine sediment on the furrow bed reduced intake rate by 50 per cent. This is ofcourse for the first few irrigations where the surge effect was

Table 3(a).Available soil moisture (%) under continuous flow

Distance (m)	Depth of sampling (cm)	Time (hr)				
		0	24	72	120	168
0-25	0-15	22.5	82.6	58.0	22.6	22.6
	15-30	38.2	79.6	69.8	55.4	47.1
26-50	0-15	35.0	72.3	44.0	30.4	20.4
	15-30	26.7	87.1	65.6	45.4	34.4
51-75	0-15	22.6	68.2	46.9	33.6	12.3
	15-30	38.2	78.0	67.8	44.8	27.3
76-100	0-15	8.2	80.0	44.8	24.6	19.8
	15-30	25.9	77.5	62.1	48.6	29.4
101-125	0-15	3.1	94.6	44.5	38.6	30.8
	15-30	26.1	64.42	47.5	24.6	12.1
126-150	0-15	4.8	95.2	53.0	35.7	15.5
	15-30	18.1	76.8	58.5	50.1	45.8

Table 3(b). Available soil moisture (%) under surge flow

Distance (m)	Depth of sampling (cm)	Time (hr)				
		0	24	72	120	168
0-25	0-15	32.9	84.1	51.4	30.0	27.3
	15-30	51.6	85.3	60.1	49.9	26.6
26-50	0-15	20.6	85.4	66.3	51.4	13.7
	15-30	17.0	86.4	71.8	46.90	33.1
51-75	0-15	19.5	62.8	54.0	33.9	5.21
	15-30	19.8	77.85	48.4	27.0	17.80
75-100	0-15	70.7	76.3	37.9	20.71	14.60
	15-30	32.6	67.4	51.5	42.10	18.50
101-125	0-15	17.35	70.5	56.3	42.8	27.6
	15-30	29.03	66.38	53.7	24.6	22.7
126-150	0-15	10.4	85.4	40.6	35.0	31.5
	15-30	17.5	82.0	53.2	37.2	33.5

Table 4. Sunflower seed yield

Distance (m)	Yield (t ha^{-1})	
	Continuous flow	Surge flow
0-25	2.08	2.08
26-50	2.42	2.51
51-75	2.17	2.16
76-100	2.63	2.83
101-125	2.89	3.01
126-150	3.17	3.30
	SED	CD (5%)
Method	0.16	NS
Distance	0.29	0.59
Method x distance	0.40	NS

more. In the present study, for the total crop period there was a saving of 19.6 per cent in surge flow compared to continuous flow. As compared the (projected) farmers, method of irrigation there was a saving of 54.7 per cent in surge flow and 43.7 per cent in continuous flow.

Moisture content and moisture depletion pattern

In general, the top layer (0-15 cm) soil has less moisture compared to the bottom layer (15-30 cm) in respect of the time of sampling except of first sampling i.e. 24 hr after irrigation. During the first sampling, the moisture (Tables 3a, 3b) content in the top layer was slightly more than the bottom layer showing that there was slow infiltration as the soil was having more of clay content. The variation in moisture content between the two depths was greater in continuous flow than in surge flow and it

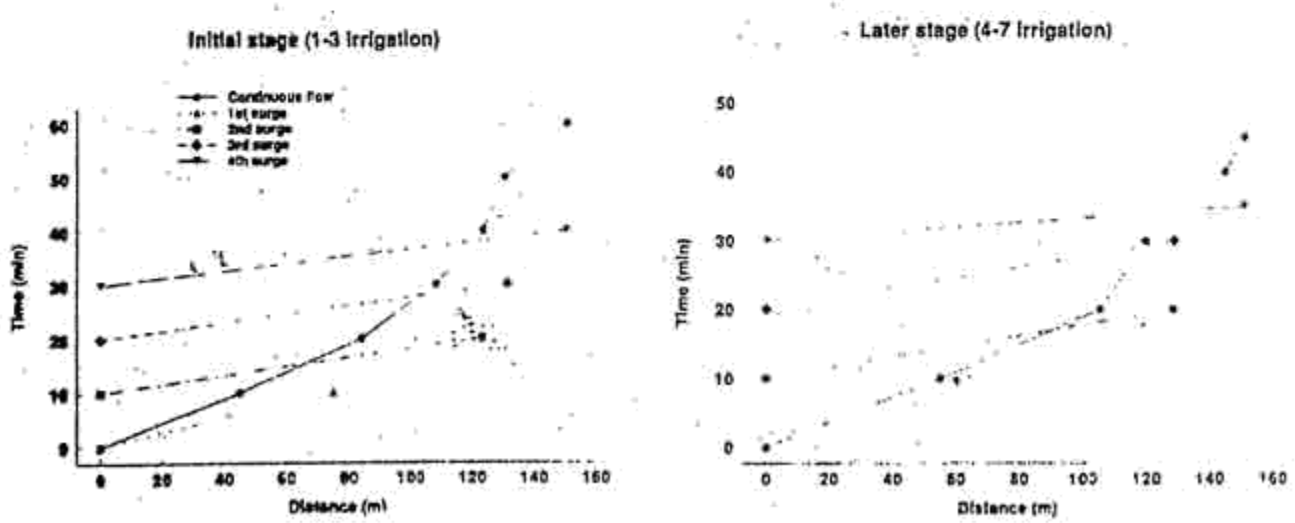
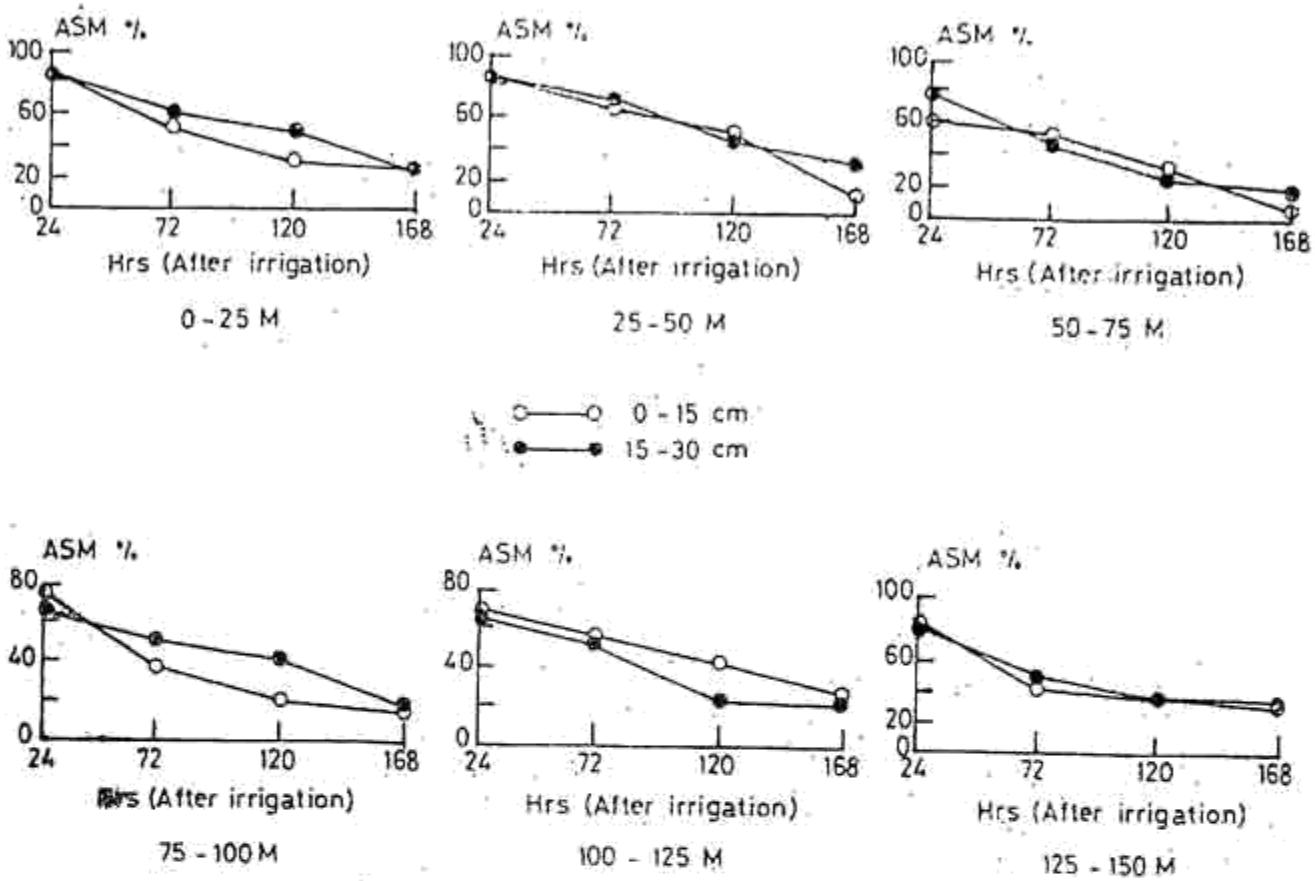


Fig. Water front advance in continuous vs. surge flow



Surge flow soil moisture per cent depletion pattern

may be due to deeper percolation in the continuous method (Tables 3a, 3b)

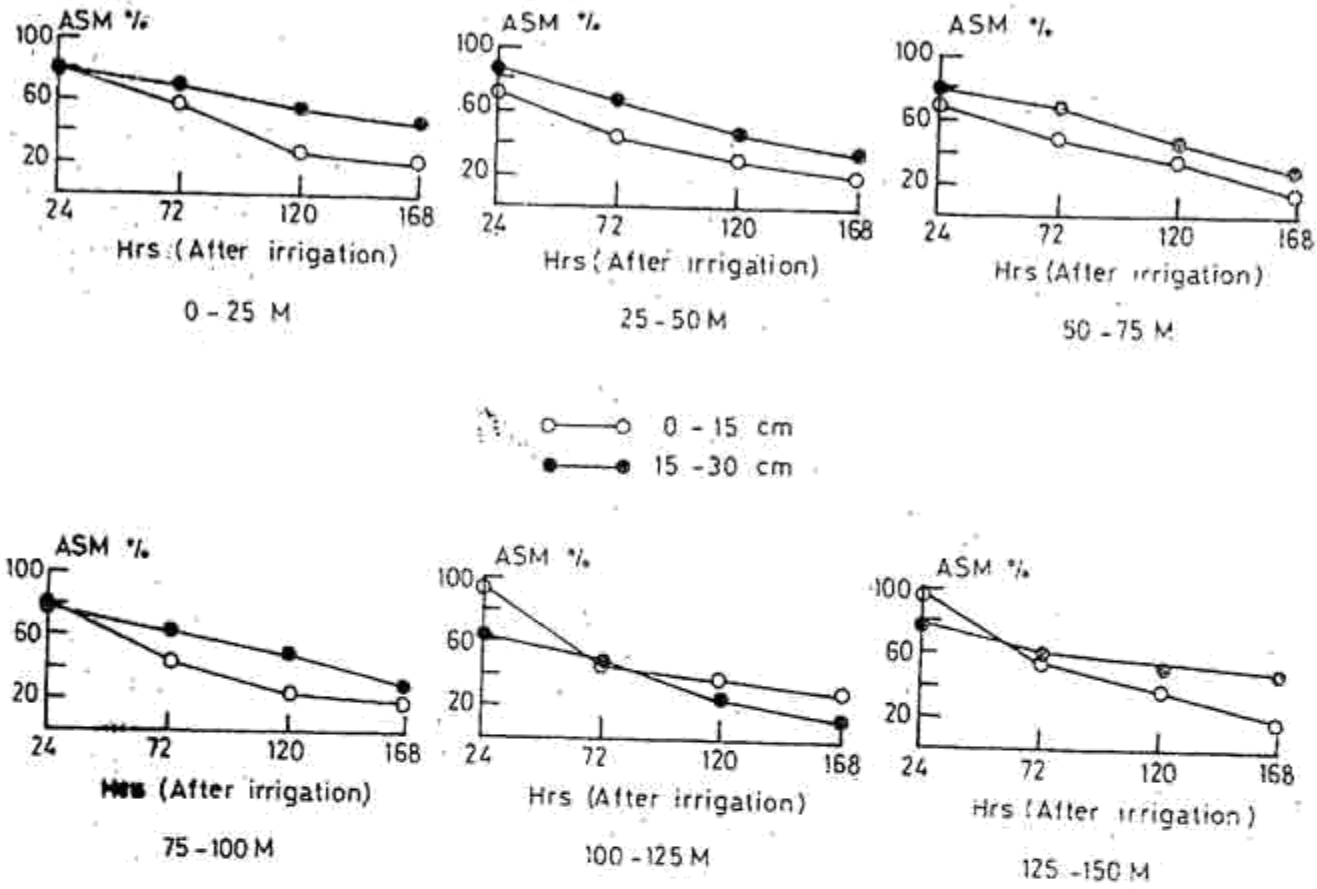
Among the two methods of irrigation, continuous flow has more moisture content in the 0-30 cm depth soil than the surge irrigation in the same depth (Fig. 2, 3). This may be attributed to the greater quantity of water consumed by the continuous flow.

The depletion pattern in both the method continuous and surge flow was almost same though in continuous flow the available soil moisture was slightly on the higher side compared to surge flow. Among the different intervals of distance along the furrow in continuous flow the variation in moisture content was the highest at the head and gradually decreases till 125 m and again it raises in the last 25 m (126 - 150 m) indicating water stagnation at the tail end. But in surge flow, the variation in the moisture content between the depth was almost uniform except in 75 to 100 m length. Again at the tail end there was more variation which was again due to water stagnation at the end but it was less compared to continuous flow. The depletion irrespective of the method was faster initially and later it slows down.

Seed Yield

There was no significant difference in seed yield between the methods i.e. between continuous flow and surge flow and the same result was obtained for the interaction also. However there was significant variation in yields for the different distances measured from head to tail.

The general trend observed was that the yield progressively increased as the distance advances irrespective of the method except at the third distance (50-75 m) for the reasons not known.



Continuous flow soil moisture per cent depletion pattern

Though this kind of result was not expected in surge flow where there should have been a uniform yield trend throughout the length with a slight depresssion in the middle distance. In continuous flow the result should have been in the reverse trend to what was obtained because of increasing quantity of water availability near the head. Intermittant rains have mitigated the differences in yield, (between the methods and within the methods under different distances) that would have otherwise been obtained as expected. The present trend of yield which is increasing progressively towards the tail end of the furrow may be attributed to the nutrients applied both basal as well as top dressing might have been carried away by the running water and deposited at the end. To confirm this further investigation is required.

A saving of 19.6 per cent water was obtained in surge flow as compared to continuous flow without any reduction in yield whereas the yield was slightly on the higher side compared to the continuous flow. However, when continuous and surge flow compared with projected farmers' method there was a considerable amount of water saving 54.7 per cent in surge flow and 43.7 per cent in continuous flow. Regarding the seed yield there was no significant differences among the methods. Surge irrigation in sunflower is observed to be successful in the given season with intermittant rainfall.

REFERENCES

BROWN, M.J., KEMPER, W.D., TROUT, T.J., and HUMHPERYS, A.S., (1988). Sediment, erosion and water in take in furrows. **Irrig. Sci. V.** : 45 - 55

HUMPHERYS, A.S. (1989). **Surge Irrigation : An Over View.** ICID Bulletin 39 (2) : 35 - 48.

RAJAGOPAL, A. (1992). **Report from Participants Under The Indo- Bulgarian Cultural Exchange Programme on Conclusion of Visit to Bulgaria (25.10.1992 to 01.12.92)** submitted to University Grants Commission, New Delhi - 110 002.

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