

Effect of irrigation and nitrogen on yield, uptake and water-use efficiency of safflower (*Carthamus tinctorius*)

G. S. KATARA AND K. N. BANSAL

Department of Agronomy, Rajasthan College of Agriculture, Rajasthan Agriculture University, Udaipur 313 001

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In order to assess the effect of nitrogen and irrigation on safflower [*Carthamus tinctorius* (L.f.) Cass.] an experiment was conducted on Vertisol soils of southern Rajasthan at Udaipur, during the winter season of 1988–89. The treatments comprised combinations of 4 levels of N (0, 30, 60 and 90 kg/ha) and 6 irrigation schedules (I₀, no irrigation; I₁, 1 irrigation at branching; I₂, 1 irrigation at flowering; I₃, 2 irrigations—1 each at branching and flowering; I₄, 2 irri-

gations—1 each at branching and grain filling; and I₅, 3 irrigations—1 each at branching, flowering and grain-filling). There were total 24 treatment combinations which were replicated thrice in randomized block design. The bulk density, field capacity and permanent wilting points in 0–30 cm soil layer were 1.43 g/cm³, 25.9 and 10.9% respectively. The soil was alkaline in reaction with pH 8.2, medium in N (0.054% total N), medium in P₂O₅ (20 kg available P₂O₅/ha)

Table 1. Effect of different levels of N and irrigation schedules on seed yield, total N and P uptake, seasonal consumptive use and water-use efficiency of safflower

Treatment	Seed yield (q/ha)	Total N uptake (kg/ha)	Total P uptake (kg/ha)	Seasonal consumptive use of water (mm)	Water-use efficiency (kg/ha/mm)	Net returns (Rs/ha)
<i>Nitrogen (kg/ha)</i>						
0	20.2	81	23.5	143.8	14.0	5,222
30	20.9	90	28.3	148.5	14.1	5,337
60	23.2	109	33.4	155.1	15.0	6,062
90	24.8	131	38.5	163.2	15.2	6,464
CD (P = 0.05)	1.76	15	5.7			196
<i>Irrigation</i>						
I ₀	17.3	62	20.1	102.7	16.8	4,029
I ₁	21.6	98	26.4	146.8	14.7	5,551
I ₂	20.7	89	25.9	145.5	14.2	5,206
I ₃	23.3	115	32.0	190.3	12.2	6,070
I ₄	25.0	120	36.0	188.6	13.2	6,738
I ₅	26.0	129	45.0	236.6	11.0	7,033
CD (P = 0.05)	2.74	19.0	7.0			240

Details of irrigation are given in text

and rich in K_2O (360.3 kg available K_2O /ha). During the crop season 10 mm rainfall was received in January. The crop was sown on 19 November 1988 and harvested on 20 April 1989.

A significant increase in seed yield was recorded up to 60 kg N/ha. Further increase in N level up to 90 kg did not increase the seed yield significantly. There was no significant difference in yields between 0 and 30 kg N/ha also (Table 1). The nitrogen uptake increased significantly up to the highest level of N, whereas P uptake increased significantly only up to 60 kg N/ha, and further increase in N level did not show significant variation in P uptake. Seasonal consumptive use and water-use efficiency also increased marginally with the increase in N level up to 90 kg/ha. Increase in N level up to 90 kg/ha significantly improved the net returns compared with lower level, recording maximum

net returns of Rs 6,464/ha. There was no significant variation in net returns due to 0 and 30 kg N/ha.

Among the various irrigation schedules, application of 2 irrigations (I_4) significantly improved the seed yield (25.0 q/ha) over the control and 1 irrigation (I_0 , I_1 and I_2), but was at par with 2 irrigations (I_3) and 3 irrigations (I_5) treatments. Total N uptake also showed similar trend. However, P uptake was maximum at 3 irrigations (I_5).

Marked increase in consumptive use of water was recorded with an increase in number of irrigations from 1 to 3 (145.5 to 236.0 mm), whereas water-use efficiency declined considerably from 14.2 to 11.0 kg/ha/mm. The maximum net return (Rs 7,033) was recorded with the application of 3 irrigations (I_5), which was significantly greater than all the lower levels of irrigation.

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Economics of integrated weed control in hybrid tomato (*Lycopersicon esculentum*)

T. V. MUNIYAPPA, N. P. DEV AND ANDANI GOWDA

*Department of Agronomy, University of Agricultural Sciences, Bangalore,
Karnataka 560 065*

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A field experiment was conducted with hybrid tomato (*Lycopersicon esculentum* Miller nom. cons.) during the rainy season of 1989. Three herbicides, viz. alachlor, metribuzin and pendimethalin, each at 2

levels as pre-emergent sprays were integrated with hand-weeding and earthing up along with controls, resulting in 21 treatments combinations. The treatments were laid out in factorial randomized block de-