Mathur (1987) obtained maximum yield with Kaolin (6%) spray in rape seed and mustard due to high net assimilation rate and high water use efficiency. Turner and Wagoner (1968) reported a reduction of water consumption in repine due to the application of phenylmercuric acetate. In the present study spraying of PMA did not show a positive influence on the kapas yield in cotton.The high kapas yield due to the spraying of the antitranspirants might have expressed through bolls and symbodia, which were in turn contributed by physiological factors like increased RWC and low stomatal count.

REFERENCES

DAS, V.S.R. and RAGHAVENDRA, A.S. 1979. **Outlook on Agriculture, 10 :** 92-98.

DAVENPORT, D.C. 1967. **Journal of Experimental Botany, 18 :** 332-347.

GALE, J.A. and Hagan, R.M. 1966. **Annual Review of Plant Physiology, 17 :** 269-282.

MATHUR, C.M. 1987. **Journal of Oilseeds Research, 4 :** 283-285.

McLAREN, J.S. 1982. **Chemical Manipulation of Crop Growth and Development.** Butterworth Scientific, London.

THANDAPANI, V. and SUBHARAYALU, M. 1986. Effect of pre-sowing seed treatment with chemicals and growth regulators for drought tolerance and yield of cotton under rained condition. **Madras Agricultural Journal, 73 :** 668-675.

TURNER, N.C. and WAGONER, P.E. 1968. **Plant physiology, 43 :** 973-978.

Madras Agric. J. 79 (8) : 430 - 436 August 1992 https://doi.org/10.29321/MAJ.10.A01774

GROWTH AND YIELD OF WINTER MAIZE INTER CROPS UNDER IRRIGATION AND PATTERN OF SOWING

T.N. PRASAD and U.K. PRASAD

ABSTRACT

In a trial conducted at Rajendra Agricultural University Farm with three irrigation levels(0.4, 0.6 and 0.8 IW : CPE ratios), two crop geometries (single and paired rows) and three intercrops (mustard radish, and coriander) along with a sole crop of maize, the inter-cropping of mustard or radish with winter maize resulted in higher yield equivalence as compared to coriander or pure crop of maize. Among irrigation levels 4 or 5 irrigations either through IW : CPE ratio of 0.6 or 0.8 gave higher yield in comparison to irrigations

Rajendra Agricultural University, Pusa - 848125, Bihar

scheduled through 0.4 ratio. Paired row sowing out yielded the conventional single row sowing. Plant height, effective length of cob and grain harvest index were significantly higher in case of IW : CPE ratio of 0.8 as compared to 0.6 or 0.4 Mustard (rai) relatively depressed the growth of maize as compared to other intercrops.

Winter maize is now one of the established rabi crops of North Bihar. In first, 50-60 days the growth rate increases rapidly while during December and January, the rate of increase rapidly slows down. During this period, there is an ample space for the growth and development of intercrops under different spatial arrangements, there is need for planting maize under different crop geometries. Also, intercrops have their differential irrigation needs depending on their growth habit and the ambient atmospheric situations. In order to quantify the relative yields of winter maize and its intercrops under different planting pattern and irrigation, there is a need for experimentation.

MATERIALS AND METHODS

An experiment to evaluate the relative performance of different intercrops with winter maize under different irrigation and planting pattern was conducted at Rajendra Agricultural University farm, Pusa during winters of 1982-83 and 1983-84. The treatments consisted of three levels of irrigation based on IW : CPE ratios of 0.4, 0.6 and 0.8 with a common depth of 6 cm of irrigation water, two crop geometries of single and paired row and three intercrops (rai, radish and coriander) with a sole crop of maize. The experiment was conducted in split plot design with irrigation in main plots and the combinations of planting pattern and intercrops in sub-plots replicated thrice. Maize and intercrops were sown on 6 November, 1982 and 31 October, 1983. During first year, radish, rai and coriander were harvested on 27 December, 10 March and 21 March, while during second year on 20 December, 27 February and 15 March. The soil of the experimental plot was sandy loam with soil pH of 8.5. The N, P and K content of the soil before sowing were 0.045 per cent, 11.8 kg/ha (Olsen P) and 115 kg/ha respectively.

RESULT AND DISCUSSION

Plant height of maize : Plant height of maize differed significantly with levels of irrigation at 90, 120 and 150 days after sowing while at 30 and 60 days the difference was not observed due to common irrigation applied at 30 days after sowing (Table 1). Irrigation scheduled through IW/CPW ratio of 0.8 resulted in tallest plant as compared to irrigation scheduled through IW/CPE ratios of 0.6 and 0.4 Plant height was more in case of 0.6 as compared 0.4. The increase in plant height may be due to rapid cell division and elongation in presence of adequate moisture as compared to relatively stressed plants (Evans, 1975).

There was no significant variation in plant height due to different crop geometries. However, at 11 stages, there was slight increase in plant height due

TABLE 1 : Effect of irrigation, crop-geometry and intercrops on plant height at different stages of growth of maize (cm)

Treatments	Pooled (1982-83 and 1983-84)				
	30	60	90	120	150
Irrigation (IW/CPE)					
0.4	27.36	53.12	64.67	89.19	135.09
0.6	28.06	54.16	72.06	104.01	143.17
0.8	29.47	55.55	78.52	115.42	156.12
SEm ±	0.79	0.72	0.62	1.09	1.70
CD 5%	NS	NS	2.43	4.27	6.66
Crop-geometry					
Single row	27.73	57.23	71.25	101.90	144.58
Paired row	27.86	57.47	72.25	103.85	145.00
SEm ±	0.42	0.57	0.65	1.08	1.19
CD 5%	NS	NS	NS	NS	NS
Intercrops					
Rai	23.87	49.67	59.53	85.85	128.58
Radish	27.73	55.90	69.00	99.27	140.41
Coriander	28.73	60.24	74.24	109.29	146.16
Maize along	30.85	63.58	84.22	117.69	164.03
SEm±	0.58	0.68	0.97	1.40	1.60
CD 5%	2.29	2.68	3.83	5.51	6.30

to paired rows as compared to single row of planting.

The height of sole crop was significantly affected by the nature of intercrops. In case of rai the height was minimum followed by radish, coriander and the sole crop. The height was less in case of rai due to more vigorous growth and exhaustive nature of the intercrop as compared to others.

The interactions between irrigation and crop geometry, crop geometry and intercrops, irrigation and intercrops as well as combination of these there were non-significant at all stages of growth.

Effective length of cob

Effect of the levels of irrigation and different intercrops was found to be significant while the effect of crop-geometry was not significant in both the years of experimentation (Table 2). Effective length of the cob was largest in case of 0.8 IW/CPE ratio followed by 0.6 and 0.4 respectively. The increase in length of cob was due to proper nutrition under adequate water supply while under stressed condition the size was reduced. Among intercrops, there was significant decrease in length of cob, when it was sown with rai followed by radish, coriander and maize along. The reduction in size was due to poor

TABLE 2 : Influence of irrigation, crop-geometry and intercrops on effective length of the cob and grain harvest index (GHI)

Treatments	Effective length of cob (cm)		Grain harvest index (%)	
	1982-83	1983-84	1982-83	1983-84
Irrigation (IW/CPE)				
0.4	11.43	13.03	40.22	38.91
0.6	11.96	14.05	40.61	39.15
0.8	12.43	15.33	40.80	39.32
SEm ±	0.11	0.17	0.03	0.04
CD 5%	0.43	0.67	0.11	0.14
Crop-geometry				
Single row	12.04	14.03	40.46	38.70
Paired row	11.84	14.24	40.23	38.54
SEm ±	0.10	0.15	0.08	0.06
CD 5%	NS	NS	NS	NS
Intercrops				
Rai	10.14	12.66	40.45	39.06
Radish	11.77	13.94	40.75	39.15
Coriander	12.77	14.78	40.09	38.93
Maize alone	13.09	15.62	40.09	38.82
SEm±	0.15	0.12	0.19	0.15
CD 5%	0.58	0.81	NS	NS

compatibility and exhaustive nature of rai. Radish also decreased the effective length as compared to coriander because of its heavy feeding of nutrients. Crop-geometry was not effective in controlling the effective length of cob.

Grain yield of maize

The grain yield of maize alone was significantly affected by irrigation and different crop-geometry. Among levels of irrigation the increase in yield was observed upto 0.6 ratio during first year and 0.8 during second year. Among intercrops rai drastically reduced the yield of maize as compared to others. This reduction was minimum in case of coriander as compared to pure crop of maize. This drastic reduction in maize in plots having maize = rai was due to exhaustive nature of rai which shared more of nutrients and poor compatibility which suppressed the vegetative growth of maize there was no influence of crop-geometry in grain yield of maize.

Grain harvest index

In the year 1982-83, grain harvest index increased with increasing level of irrigation. Irrigation at 0.8 IW/CPE ratio recorded significantly higher value of GHI (40.80) followed by 0.6 (40.61)

and 0.4 (40.22) ratios which were also significantly different between themselves. During second year also, significant higher grain harvest index was noticed under irrigation at 0.8 IW/CPE ratio (39.32) followed in descending order by irrigation at 0.6 (39.15) and 0.4 (38.91) ratios. On an average, irrigation scheduled through 0.8 and 0.6 IW/CPE ratio recorded 1.24 and 0.78 per cent higher values of grain harvest index respectively as compared to 0.4 ratio.

Crop geometry as well as intercrops failed to cause any significant variations in grain harvest index of the maize crop in either of the season. Similarly, none of the interactions in any of the year was found to be significant in relation to grain harvest index.

Yield equivalence in terms of maize

As it is not possible to assess the total effect of sole crop or intercrops with only maize yield, the yield of intercrops were converted to maize yield on the prevailing market price of intercrops and maize. The analysed data of maize equivalence clearly indicated that the maize equivalence was highest in case of maize + radish during first year and maize mustard during second year. The second one was maize + coriander in both the years. The higher yield equivalence in case of rai during second year was due to abrupt increase in price from Rs.365.00/q to Rs.468.00/q during second year. Secondly, the price of radish declined from Rs.40/q during first year to 30/q during second year. On the basis of the first year price maize + radish to maize + coriander may be treated as superior to maize + rai.

Significant increase in yield equivalence was recorded with increase in the levels of irrigation in both the seasons (Table 3). On an average, irrigation at 0.8 and 0.6 IW/CPE ratio recorded 22.31 and 12.95 per cent more value of yield equivalence than irrigation at 0.4 IW/CPE ratio. Higher yield equivalence under 0.8 ratio of irrigation might be due to higher grain production of different crops with higher level of soil moisture, water stress also reduced the capacity of the protoplasm to carry on photosynthesis efficiently and reduced translocation might hinder it by accumulation of end product. The reduction in photosynthesis, decreased translocation of carbohydrates and growth regulators and disturbances in nitrogen metabolism - all added to the effects of reduced turgor in reducing growth (Kramer, 1969).

However, when the yields of intercrops were concerted in terms of maize and the yield equivalent values of intercrops + maize were analysed, there was significant difference between single row and paired row system. In both the years, yield was higher in paired row than the single row. During first year, the per cent increase over single row was 4.41 while during second year it was 9.52. This variation was observed due to higher yield of intercrops under paired row system than single one. In single row system, the plants were relatively more shaded and less free to environmental syndrome that determines

TABLE 3 : Influence of irrigation, crop-geometry and intercrops on mean grain yield of maize, mean yield equivalence, irrigation water applied and water - use efficiency on the basis of yield equivalence

Treatments	Grain yield (q/ha)		Yield equivalence (q/ha)		Irrigation water applied (cm)		Water-use efficiency (kg/ha-cm)	
	1982-83	1983-84	1982-83	1983-84	1982-83	1983-84	1982-83	1983-84
Irrigation (IW/CPE)								
0.4	35.87	35.16	58.95	63.23	18	18	327	351
0.6	40.44	42.47	66.07	71.92	24	24	275	300
0.8	43.40	47.44	69.45	79.98	30	30	232	267
SEm±	1.26	1.15	1.16	1.23			4.3	5.5
CD 5%	4.93	4.51	4.54	4.82			16.8	21.4
Crop-geometry								
Single row	40.38	41.62	63.42	68.45	24	24	272	292
Paired row	39.42	41.74	66.22	74.79	24	24	284	320
SEm±	0.60	0.59	0.69	0.78			3.2	3.6
CD 5%	NS	NS	2.71	3.05			12.4	14.0
Intercrops								
Rai	22.36	27.08	65.19	84.59	24	24	278	363
Radish	40.40	42.63	78.23	73.62	24	24	338	314
Coriander	47.40	46.87	66.42	78.46	24	24	284	333
Maize alone	49.44	50.17	49.44	50.17	24	24	212	213
SEm±	0.84	0.83	0.98	1.10			4.4	5.0
CD 5%	3.31	3.26	3.84	4.31			17.5	19.8

the yield than paired row here the availability of incident radition was more. Higher yield of maize with intercrops under paired row sowing was also reported by Colville and McGill (1962) and Rathore et al. (1980)at Udaipur (Rajasthan).

Water requirement and water-use efficiency

Water requirement under IW/CPW ratio of 0.4 to 0.8 varied between 18 cm to 30 cm, highest being at 0.8 ratio. Water-use efficiency was calculated on the basis of maize equivalence (Sole + intercrops). The value was highest in case of driest regime followed by 0.6 and 0.8 ratios. The value was higher because of the fact that yield reduction was not so much affected in case of drier regime as compared to wet ones. Water-use efficiency was also higher in case of paired row planting due to higher yield as compared to single row. The effect of intercrops was also pronounced on this parameter. The lowest value was

recorded in case of pure maize as compared to intercrops. Among intercrops, the value varied as per variation in their yield in respective years. In case of single row and paired rows, water applied was similar and same was the case among intercrops. Therefore, the variation was yield dependent that the quantity of water.

REFERENCES

VOLVILLE, W.L. and McGILL, D.P. (1962). Effect of ratio and method of planting corn on several plant characters and yield of irrigated corn. Agron. J., 54 : 235 - 38.

EVANS, L.T. (1975). Crop physiology. Published by the syndics of the Cambridge University Press, Bently House, 200 Euston Road, London, NWI 2 DB.

KRAMER, P.J. (1969). Plant and soil-water relationship. A modern synthesis. Tata MC Graw Hill Publishing Company Ltd., Bombay, New Delhi.

OLSEN, S.R., COLE, C.U., WATNABE, F.S. and DEAN, L.A. (1954). Estimation to available phosphorus in soils by extraction with $NaHCO_3$. USDA Circular, 939.

RATHORE, S.S., CHAUHAN, G.S. and SINGH, H.G. (1980). Stand geometry of maize and its intercropping with pulses under dryland agriculture. **Indian J. Agron.25 (3)** : 319 - 322.

Madras Agric. J. 79 (8) : 436 - 439 August 1992

STUDIES ON COMBINING ABILITY IN BLACK GRAM (Vigna mungo(L) Hepper)

S. RAJARATHINAM[1] and R. RATHNASWAMY[2]

ABSTRACT

Combining ability was studied in a 6 x 6 diallel set in blackgram (Vigna mungo (L.) Hepper) for seed yield and its seven components. The g.c.a. effects of the parents showed that T9 was a good general combiner for number of pods per plant and seed yield. The crosses Du 1 x ADT 3 and NPRB 2 x KB 70 gave positive significant s.c.a. effects for number of clusters per plant, number of pods per plant and seed yield per plant. These were identified as promising crosses.

The present study was undertaken on an 6 x 6 diallel cross to derive information on general and specific combining ability variances and effects for eight quantitative characters in blackgram (Vigna mungo (L) Hepper).

1. Assistant Professor (Breeding), Cotton Research Station, Srivilliputtur - 626 125.

2. Professor and Head, National Pulses Research Centre, Pudukkottai - 622 001