

Studies on Mixed Cropping of Legumes with Maize Under Rainfed Conditions*

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An experiment was conducted at the Research Farm, Meerut University, Meerut during *Kharif* 1973 and 1974, to study the influence of different nitrogen levels on yield attributes of maize when grown alone and in association with different legumes under rainfed conditions. Legumes in association with maize increased the yield and yield attributes of maize grain. *Urad* was found to be the most suitable companion crop. Application of 120 kg N/ha showed better effect in well distributed rainfall year while application of 80 kg N/ha has equally effective in ill distributed rainfall year. Application of nitrogen proved helpful in increasing the yield and yield attributes of maize while the component crops remained unaffected.

In India, the practice of mixed cropping is very common in rainfed area. This is being considered as a safeguard against total failure of main crop. (During *Kharif* season, growing maize with legumes is very common in western Uttar Pradesh, Punjab, Haryana and some parts of Rajasthan. Different kinds of leguminous crops are raised in mixed cropping.) In recent years, short duration and erect type legume varieties suitable for multiple and mixed cropping have been evolved. Adequate fertilization of mixed stand needs thorough understanding of the crops and their behaviour in mixed culture. Pathak *et al.* (1973) reported that nitrogen fixed by legumes might not have been sufficient enough to induce extra yield of maize. No considerable information is available on the growing of high yielding variety of maize along with legume

like cowpea, *urad*, *mung*, groundnut and soybean. The present experiment was, therefore, conducted to analyse the effect of different levels of nitrogen on yield and yield attributes of pure and mixed crop of maize under rainfed conditions.

MATERIAL AND METHODS

Experiments were conducted during *Kharif* 1973 and 1974 at the Research Farm, Meerut University, Meerut. The soil of experimental field was sandy clay loam (pH 7.1, total N-0.046 per cent and organic carbon 0.50 per cent) with good drainage. In the first year well distributed rainfall (607 mm.) was recorded throughout the crop period. However, during second year the total amount of rainfall was 708 mm, out of which 660 mm (94.6%) was recorded

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from 1st week of July to 15th of August and the remaining period of crop growth remained dry.

The treatment consisted of the combination of six crop mixtures (C_1 - maize pure, C_2 - maize + *mung*, C_3 - maize + groundnut, C_4 - maize + soybean, C_5 - maize + *urad* and C_6 - maize + Cowpea) and the three levels of nitrogen (40, 80 and 120 kg N/ha) and the trials were laid out in randomised block design with factorial concept and replicated four times. Phosphorous and potash were applied uniformly at the rate of 60 and 40 kg/ha respectively. Half of the dose of nitrogen and full dose of P and K were applied as basal. Remaining quantity of nitrogen was side dressed with maize rows at knee high stage. Maize was sown in 75 cm x 25 cm spacing one row of legume crop was sown in between maize rows.

RESULTS AND DISCUSSION

The yield data revealed that mixed cropping of maize with legumes like *urad*, *mung* and cowpea was significantly superior to pure crop in both years (Table II). In 1973, maximum yield of maize was recorded with cowpea and *mung* association, but in 1974, it was with *mung* and *urad*. Mixed cropping with legumes like groundnut, soybean was found comparatively inferior in both the years. Gautam *et al* (1964) also obtained higher yield of maize when grown with *mung*, cowpea and soybean. The variation in yield in different mixed cropping treatment from year to year might be due to fluctuations in the growth of legumes on

account of differences in the climate of two years.

Maize yield was significantly influenced by level of nitrogen in both the years. Maximum yield was recorded with 120 kg N/ha in both the years. The increase in maize yield with increasing levels of nitrogen has also been reported by Pathak *et al* (1970). The distribution of rainfall played a significant role on the response of different levels of nitrogen. In 1973, when well distributed rainfall was recorded, the effect of 120 kg N/ha was superior to other lower doses, but in 1974, though higher rainfall was received but due to ill-distributed rainfall, 120 kg N and 80 kg N/ha were at par with each other.

Mixed cropping of maize with legumes significantly increased the yield/plant and grain number/cob over pure cropping of maize during both the years. The number of grain/cob also followed the similar trend as observed in the yield/plant. This increase in yield and yield contributes of maize, may be due to the fact, that the growing of maize in association with legumes like *mung*, *urad* and cowpea favourably affected its leaf area, RGR, root growth and dry matter production compared to maize alone. This is in agreement with the findings of Evans (1960) and Moor (1927). Nitrogen fertilization at the rate of 120 kg and 80 kg/ha significantly improved the yield attributes like average weight of cob/plant, 1000 grain weight, number of grains/cob and diameter of cob over 40 kg N/ha in both the years. It is apparent that maize responded favourably to nitrogen application under rainfed conditions. The

TABLE I. Yield and yield attributes of maize as affected by nitrogen and legume association

Treatments	Grain yield (Q/ha)		Grain yield per plant (gm)		No. of grains per plant		Diameter of cob (cm)		Mean weight of cob. (gm)		1000 grain weight (gm)	
	1973	1974	1973	1974	1973	1974	1973	1974	1973	1974	1973	1974
C ₁ —Maize pure	15.17	12.96	70.80	60.16	328.94	209.03	13.59	10.52	116.60	68.02	184.68	167.27
C ₂ —Maize + mung	19.70	16.00	86.41	67.20	386.80	247.39	13.27	10.55	123.96	72.25	200.12	168.12
C ₃ —Maize + groundnut	17.70	14.67	75.58	62.35	343.08	213.58	13.28	10.65	118.23	65.26	184.80	166.65
C ₄ —Maize + soybean	15.71	13.35	78.07	64.07	335.94	218.89	13.07	10.46	122.07	73.60	190.90	167.70
C ₅ —Maize + Urad	17.47	15.89	85.91	68.07	355.80	246.61	13.42	10.57	126.07	75.21	195.90	169.04
C ₆ —Maize + cowpea	19.33	13.95	87.15	60.38	389.25	213.86	13.04	10.32	130.21	71.58	195.61	168.38
CD at 5%	2.59	2.33	12.98	7.00	55.75	37.28	NS	NS	NS	NS	NS	NS
N ₁ —40 kg N/ha	12.84	11.47	68.89	53.41	301.73	192.93	12.94	10.12	101.45	62.09	181.83	153.35
N ₂ —80 kg N/ha	17.81	16.53	83.14	63.78	357.03	231.39	13.25	10.94	133.93	75.92	199.60	174.31
N ₃ —120 kg N/ha	21.92	15.41	90.07	63.38	391.15	219.86	13.66	10.48	133.18	74.95	195.08	164.92
CD at 5%	1.83	1.63	9.18	7.47	39.45	27.09	0.47	0.67	12.10	9.94	10.34	10.11

NS — Not significant

TABLE II. Effect of mixed cropping x nitrogen levels interaction on maize grain yield (gm/plant)

Nitrogen levels	Crop mixtures					
	Maize pure	Maize + mung	Maize + groundnut	Maize + soybean	Maize + Urad	Maize + cowpea
N ₁ 40 kg N/ha	43.9	67.6	67.0	71.8	80.7	70.8
N ₂ 80 kg N/ha	80.6	103.2	80.0	77.9	84.3	78.5
N ₃ 120 kg N/ha	90.7	90.5	79.7	84.7	96.50	101.4

CD at 5% - 22.49

magnitude of response was governed by the distribution of rainfall.

It is seen from the Table - II that at 40 kg N/ha level, maize alone gave comparatively lower yield to mixed cropping. At 80 kg N/ha level maize + *mung* was found better, but did not differ with maize + *urad*. However, at 120 kg N/ha level, maximum yield/plant was recorded in maize + cowpea and found as good as maize pure and maize + *urad*.

It was further observed (Table II) that maize alone, maize + *mung*, maize + groundnut produced significantly higher yield of maize/plant at 80 and 120 kg N/ha level over 40 kg N/ha level. However, maize + *urad* did not differ significantly by different nitrogen levels.

Yield contributing characters of legumes i.e. number of pods/plant and 1000 grain weight were found to be significantly affected by nitrogen levels during 1974 only (Table III). The rate 80 kg N/ha significantly increased the number of pods/plant over 40 and 120 kg N/ha and the higher doses were at par with each other. It is interesting to note that unlike maize crop, yield and yield attributes of component crops (legumes) was not affected significantly by any of the nitrogen levels. It is therefore, evident that the application of nitrogen proved helpful in increasing the yield and yield attributes of the principal crop only while the component crops remained unaffected. Thomas and Bennett (1975) reported that nitrogen application increased the yield of maize but

TABLE III. Mean yield and yield attributes of legumes as influenced by nitrogen levels

Nitrogen levels	Mean values of legumes (Average of different legumes)							
	Grain yield g/ha		Number of pods/plant		Pod yield plant (gm)		1000 grain weight (gm)	
	1973	1974	1973	1974	1973	1974	1973	1974
N ₁ 40 kg N/ha	5.61	6.29	24.6	33.2	13.2	18.4	139.1	133.2
N ₂ 80 kg N/ha	5.60	6.27	26.7	36.7	12.9	20.1	132.5	130.2
N ₃ 120 kg N/ha	5.03	6.13	26.3	36.0	12.7	20.5	133.9	119.8
CD at 5%	NS	NS	NS	3.34	NS	NS	NS	11.63

NS - Not significant

slightly reduced the same in legumes grown in association with maize.

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