



## Effect of intercrops and nutrients on yield attributes and yield of rainfed pearl millet

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**Abstract:** Field experiments conducted during *kharif* (September-December) 1997 and 1998 on rainfed pearl millet at Tamil Nadu Agricultural University, Coimbatore revealed that grain yield of pearl millet was reduced by intercropping cowpea and sunflower compared to sole stand. The pearl millet + cowpea intercropping resulted in significantly lower pearl millet grain equivalent yield compared to pearl millet as sole crop or pearl millet + sunflower intercropping. Pearl millet yield was significantly lower in unfertilised control. Grain yield of pearl millet was significantly enhanced by addition of 60 kg N ha<sup>-1</sup>. Further addition of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> and 20 kg ZnSO<sub>4</sub> ha<sup>-1</sup>, resulted in additional yield under rainfed conditions.

**Key words:** Pearl millet, Intercropping, Nutrient management, Yield attributes, Yield.

### Introduction

Pearl millet (*Pennisetum glaucum* (L.) P. Br. emend Stuntz) is an important food and fodder crop in India, which is often cultivated under drought, with erratic rainfall and in low fertile soils. Intercropping in pearl millet is practised by farmers to minimise risks and to effectively utilise the available rainfall. Umrani (1981) have reported that the productivity in medium deep vertisols could considerably be increased with intercropping of pearl millet + pigeonpea. This intercropping was also more stable and remunerative than sole cropping during *kharif* season. Gautam (1994) has also reported that pearl millet + pigeonpea at 1:1 or 2:1 ratio proved to be superior compared to sole pearl millet or pigeonpea. Significant response to fertiliser application under rainfed condition has been reported in pearl millet (Raghuwanshi *et al.* 1998). Dahiya *et al.* (1998) have also reported that yield attributes and yield of pearl millet increased with increasing levels of fertility upto 120 kg N + 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. Hence, to study the effect of different intercrops in pearl millet under various fertiliser treatments, the present study was undertaken.

### Materials and Methods

Field experiments were conducted at Tamil Nadu Agricultural University, Coimbatore during *kharif* (September-December) of 1997 and 1998 under rainfed condition. In 1997, the trial was sown on 16.9.97 and harvested

on 18.12.97 and the receipt of total rainfall during the cropping period was 420 mm. During 1998, the dates of sowing and harvest of the trial were 18.9.98 and 5.1.99 with a total of 598 mm of rainfall.

The experimental soil was vertisol with a pH of 8.2 and low in available N and P<sub>2</sub>O<sub>5</sub> (158 and 6.8 kg ha<sup>-1</sup>, respectively) and high in available K<sub>2</sub>O (446 kg ha<sup>-1</sup>). The experiment was laid out in a split plot design with three replications. The treatments consisted of;

#### Mainplot (cropping)

- C1 - Sole pearl millet
- C2 - Pearl millet + cowpea (1:1 in 1997 and 2:1 in 1998)
- C3 - Pearl millet + sunflower (1:1 in 1997 and 2:1 in 1998)

#### Subplot (Fertiliser levels)

- F1 - Unfertilized control
- F2 - 60 kg N ha<sup>-1</sup>
- F3 - 60 kg N ha<sup>-1</sup> + 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>
- F4 - 60 kg N + 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> + 20 kg ZnSO<sub>4</sub> ha<sup>-1</sup>

Pearl millet, variety ICMH 451 and CO 6 cowpea and CO 1 sunflower, were used in the trials. A gross plot size of 5.0 m x 7.0 m and a net plot size of 4.4 m x 6.0 m was adopted. Pearl millet was sown at 45 x 15 cm spacing and the intercrops at 30 x 15 cm spacing. Observations on growth, yield attributes and grain yield of pearl millet

Table 1. Effect of treatments on yield attributes and yield of pearl millet in 1997

| Treatment   | Plant height (cm) | Effective tillers/plant | Ear length (cm) | Ear girth (cm) | Grain yield (kg ha <sup>-1</sup> ) | Grain equivalent yield (kg ha <sup>-1</sup> ) |
|---|-------------------|-------------------------|-----------------|----------------|------------------------------------|---|
| C <sub>1</sub> - Sole pearl millet (PM)   | 124.1             | 2.8                     | 22.1            | 9.6            | 1230                               | 1230  |
| C <sub>2</sub> - PM + Cowpea  | 121.9             | 2.8                     | 21.9            | 9.5            | 607+66*                            | 707   |
| C <sub>3</sub> - PM + Sunflower   | 123.3             | 2.9                     | 22.0            | 9.6            | 613+602*                           | 1215  |
| CD for C  | NS                | NS                      | NS              | NS             | 40.9                               | 66.9  |
| F <sub>1</sub> - Control  | 111.6             | 2.2                     | 19.6            | 9.1            | 574(59/448)**                      | 753   |
| F <sub>2</sub> - 60 kg N ha <sup>-1</sup>   | 125.5             | 3.0                     | 22.4            | 9.6            | 868(51/590)**                      | 1090  |
| F <sub>3</sub> - 60 kg N ha <sup>-1</sup> + 30 kg P <sub>2</sub> O <sub>5</sub> ha <sup>-1</sup> + 20 kg ZnSO <sub>4</sub> ha <sup>-1</sup> | 126.9             | 3.2                     | 22.7            | 9.8            | 933(75/708)**                      | 1206  |
| CD for F  | 3.96              | 0.28                    | 0.89            | 0.08           | 26.7                               | 36.7  |
| CD for F at C   | NS                | NS                      | NS              | NS             | 46.3                               | 63.5  |
| CD for C at F   | NS                | NS                      | NS              | NS             | 56.8                               | 85.8  |

\* Pearl millet yield + intercrop yield

\*\* Within paranthesis (Numerator = Cowpea yield, denominator = sunflower yield)

Table 2. Effect of treatments on yield attributes and yield of pearl millet in 1998

| Treatment   | Plant height (cm) | Effective tillers/plant | Ear length (cm) | Ear girth (cm) | Grain yield (kg ha <sup>-1</sup> ) | Grain equivalent yield (kg ha <sup>-1</sup> ) |
|---|-------------------|-------------------------|-----------------|----------------|------------------------------------|---|
| C <sub>1</sub> - Sole pearl millet (PM)   | 202.0             | 3.0                     | 27.1            | 9.6            | 723                                | 723   |
| C <sub>2</sub> - PM+ Cowpea   | 186.8             | 2.8                     | 26.8            | 9.5            | 637+20*                            | 657   |
| C <sub>3</sub> - PM+ Sunflower  | 187.8             | 2.9                     | 27.3            | 9.5            | 657+237*                           | 894   |
| CD for C  | 4.94              | NS                      | NS              | NS             | NS                                 | NS  |
| F <sub>1</sub> - Control  | 173.8             | 2.2                     | 24.8            | 9.1            | 293(14/176)**                      | 357   |
| F <sub>2</sub> - 60 kg N ha <sup>-1</sup>   | 187.3             | 2.9                     | 27.3            | 9.6            | 604(19/232)**                      | 688   |
| F <sub>3</sub> - 60 kg N + 30 kg P <sub>2</sub> O <sub>5</sub> + 20 kg ZnSO <sub>4</sub> ha <sup>-1</sup> | 197.4             | 3.2                     | 27.8            | 9.7            | 815(22/262)**                      | 910   |
| CD for F  | 6.16              | 0.17                    | 0.77            | 0.07           | 199.7                              | 198.8   |
| CD for F at C   | NS                | NS                      | NS              | NS             | NS                                 | NS  |
| CD for C at F   | NS                | NS                      | NS              | NS             | NS                                 | NS  |

and intercrops were recorded and pearl millet grain equivalent yield was also worked out. The data were subject to statistical scrutiny and presented in Tables 1 and 2.

## Results and Discussion

### Plant height and yield attributes

Plant height of pearl millet was lesser under intercropping situation compared to sole

stand in both the years of study, though it failed to attain the level of significance in 1997. This was mainly because of the competitive effect of the intercrop on the base crop of pearl millet (Sivakumar, 1993). Yield attributes recorded *viz.* effective tillers plant<sup>-1</sup>, ear length and ear girth were not significantly influenced by intercropping. Khateek *et al.* (1999) have also reported that intercropping

pearl millet with cowpea, clusterbean or greengram did not affect yield components of pearl millet. Whereas, plant height and yield attributes were significantly influenced by fertilizer treatments. Significantly lower values were recorded in the unfertilised control treatment (F1) compared to other treatments. By addition of 60 kg N ha<sup>-1</sup> alone, the plant height and yield attributes were significantly increased. This is in accordance with the earlier reports of Yadava (1998) on the favourable influence of N addition on pearl millet growth and yield attributes.

#### *Pearl millet grain yield and grain equivalent yield*

Grain yield of pearl millet was less under intercropping with cowpea and sunflower compared to sole pearl millet. In 1997 yield was significantly less under intercropping while in 1998, though grain yield was less under intercropping it failed to reach the level of significance. This was mainly due to lesser population of pearl millet under intercropping situation in 1997 as the pearl millet intercrops were raised in 1:1 ratio compared to 2:1 in 1998. Bhadoria *et al.* (1992) have also reported yield reduction in pearl millet with reduction in pearl millet population under intercropped situation. The present finding of yield reduction under intercropping in pearl millet corroborates the earlier reports of Sivakumar (1993) who reported that pearl millet yield reduction was observed when intercropped with cowpea because of the competitive effects during early stages. Pearl millet grain equivalent yield was lesser under pearl millet + cowpea intercropping situation compared to pearl millet + sunflower intercropping and pearl millet in sole stand. This was mainly because of higher pearl millet yield reduction under pearl millet + cowpea intercropping situation and also due to reduced yield of intercrop, cowpea compared to sunflower grain yield in pearl millet + sunflower system.

Fertiliser treatment significantly influenced the pearl millet grain yield and pearl millet grain equivalent yield in both the years of study. Lowest yield was recorded in unfertilised control (F1). This might be due to low initial N and P<sub>2</sub>O<sub>5</sub> status of the soil,

which limited the yield of pearl millet to low levels. Addition of 60 kg N ha<sup>-1</sup> (F2) significantly increased the yield, which was further increased by addition of 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> (F3). This is in accordance with the earlier report by Gautam (1994) who found that additional dose of 15 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> along with 30 kg N ha<sup>-1</sup> significantly increased the grain equivalent yield over 30 kg N ha<sup>-1</sup> alone. Dahiya *et al.* (1998) have also reported that yield attributes and yield of pearl millet increased with increasing levels of fertility upto 120 kg N + 60 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. Pearl millet grain yield and grain equivalent yield were the highest when 20 kg of ZnSO<sub>4</sub> ha<sup>-1</sup> was added in addition to 60 kg N + 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> under rainfed vertisol conditions.

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