

## Pearlmillet (*Pennisetum glaucum*)-based crop mixtures under rainfed conditions

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### ABSTRACT

A field experiment was conducted at the Agricultural Research Station, Durgapura, during the rainy (*khari*f) season of 1992 and 1993 to work out most remunerative mixed or intercropping system of pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz] and legumes compared with solid pearl millet under rainfed condition. Sowing with mixture of 75% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram (*Phaseolus radiatus* L.), cowpea [*Vigna unguiculata* (L.) Walp.] and clusterbean [*Cyamopsis tetragonoloba* (L.) Taubert] gave the highest economic return (Rs 9,671/ha), followed by mixture of 50% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean (Rs 9,338/ha), which was 19 and 14.9% higher than that of solid pearl millet. The solid pearl millet gave an economic return of Rs 8,125/ha.

Mixed or intercropping is practised in rainfed areas of Rajasthan for reduction of risk, but recently intercropping has been recognized as potentially beneficial system of crop production. The productivity in terms of base-crop equivalent increases by 7–26 q/ha, thereby achieves additional monetary returns 15–100% (Rathore, 1992). The substantial yield advantage may be especially important because they are achieved not by means of costly input but by simple expedient of growing crops together (Willey, 1979). To get best results, a suitable mixed or intercropping system is desired. Keeping this in view, an experiment was conducted to work out suitable and remunerative mixed or intercropping system for the micro-farming situation of rainfed, coarse-textured soil of semi-arid eastern plains zone of Rajasthan.

### MATERIALS AND METHODS

The experiment was conducted at the Ag-

ricultural Research Station, Durgapura, Jaipur, during the rainy (*khari*f) season of 1992 and 1993. Twelve treatments consisted of solid pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz], paired planting of greengram (*Phaseolus radiatus* L.) or cowpea [*Vigna unguiculata* (L.) Walp.] or clusterbean [*Cyamopsis tetragonoloba* (L.) Taubert], mixture of recommended seed rate of pearl millet + 25% of the recommended seed rate of greengram or cowpea or clusterbean, mixture of 75% of the recommended seed rate of pearl millet + 50% of the recommended seed rate of greengram or cowpea or clusterbean and mixture of 75% and 50% of the recommended seed rates of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean. The treatments were replicated 4 times in randomized block design. The soil of experimental site was loamy sand in texture, having pH 8.0, organic carbon 0.18%, available P<sub>2</sub>O<sub>5</sub> 60 kg/ha and K<sub>2</sub>O 240 kg/ha. Sowing

Table 1. Effect of crop mixtures on grain yield of pearl millet and inter or mixed crop, pearl millet-equivalent yield and stover yield

| Treatment                                                                             | Grain yield (kg/ha)    |                     |                        |                     | Pearlmillet-equivalent yield (kg/ha) |       | Stover yield (kg/ha) |       |
|---------------------------------------------------------------------------------------|------------------------|---------------------|------------------------|---------------------|--------------------------------------|-------|----------------------|-------|
|                                                                                       | 1992                   |                     | 1993                   |                     | 1992                                 | 1993  | 1992                 | 1993  |
|                                                                                       | Main crop pearl millet | Inter or mixed crop | Main crop pearl millet | Inter or mixed crop |                                      |       |                      |       |
| Solid pearl millet                                                                    | 813                    |                     | 2,164                  |                     | 813                                  | 2,164 | 2,986                | 4,514 |
| Paired planting of pearl millet with greengram                                        | 782                    | 53                  | 2,002                  | 19                  | 945                                  | 2,065 | 2,824                | 4,282 |
| Paired planting of pearl millet with cowpea                                           | 532                    | 168                 | 2,164                  | 88                  | 887                                  | 2,369 | 2,431                | 4,398 |
| Paired planting of pearl millet with clusterbean                                      | 661                    | 181                 | 1,944                  | 185                 | 939                                  | 2,376 | 2,870                | 4,051 |
| Mixture of full seed rate of pearl millet + 25% seed rate of greengram                | 627                    | 64                  | 2,118                  | 15                  | 824                                  | 2,168 | 3,009                | 4,398 |
| Mixture of full seed rate of pearl millet + 25% seed rate of cowpea                   | 799                    | 144                 | 1,921                  | 31                  | 1,104                                | 1,993 | 2,986                | 4,051 |
| Mixture of full seed of pearl millet + 25% seed rate of clusterbean                   | 692                    | 139                 | 2,083                  | 188                 | 906                                  | 2,522 | 3,032                | 4,167 |
| Mixture of 75% seed rate of pearl millet + 50% seed rate of greengram                 | 748                    | 130                 | 2,129                  | 15                  | 1,148                                | 2,179 | 2,593                | 4,282 |
| Mixture of 75% seed rate of pearl millet + 50% seed rate of cowpea                    | 599                    | 291                 | 2,199                  | 77                  | 1,215                                | 2,379 | 3,009                | 4,398 |
| Mixture of 75% seed rate of pearl millet + 50% seed rate of clusterbean               | 546                    | 248                 | 2,037                  | 196                 | 928                                  | 2,494 | 2,917                | 4,051 |
| Mixture of 75% seed rate of pearl millet + 25% seed rate each of greengram and cowpea | 868                    | 66                  | 2,106                  | 13                  | 1,368                                | 2,663 | 3,125                | 4,514 |
| clusterbean                                                                           |                        | 105                 |                        | 38                  |                                      |       |                      |       |
| Mixture of 50% seed of pearl millet + 25% seed each of greengram and cowpea           | 741                    | 65                  | 1,956                  | 16                  | 1,356                                | 2,558 | 3,032                | 4,282 |
| clusterbean                                                                           |                        | 127                 |                        | 50                  |                                      |       |                      |       |
|                                                                                       |                        | 95                  |                        | 185                 |                                      |       |                      |       |

Table 2. Effect of different crop mixtures on economic return (Rs/ha) from pearl millet-based cropping systems

| Treatment                                                                                         | Economic returns (Rs/ha) |       |        |       | Total return (Rs/ha) |        |       |
|---------------------------------------------------------------------------------------------------|--------------------------|-------|--------|-------|----------------------|--------|-------|
|                                                                                                   | Grain                    |       | Stover |       | 1992                 | 1993   | Mean  |
|                                                                                                   | 1992                     | 1993  | 1992   | 1993  |                      |        |       |
| Solid pearl millet                                                                                | 2,111                    | 6,493 | 3,130  | 4,514 | 5,240                | 11,007 | 8,125 |
| Paired planting of pearl millet with greengram                                                    | 2,454                    | 6,201 | 2,958  | 4,282 | 5,412                | 10,484 | 7,949 |
| Paired planting of pearl millet with cowpea                                                       | 2,306                    | 7,109 | 2,549  | 4,398 | 4,854                | 11,507 | 8,181 |
| Paired planting of pearl millet with clusterbean                                                  | 2,440                    | 7,130 | 3,014  | 4,051 | 5,454                | 11,181 | 8,319 |
| Mixture of full seed rate of pearl millet + 25% seed rate of greengram                            | 2,132                    | 6,500 | 3,264  | 4,514 | 4,396                | 11,014 | 8,208 |
| Mixture of full seed rate of pearl millet + 25% seed rate of cowpea                               | 2,870                    | 5,984 | 3,144  | 4,051 | 6,014                | 10,032 | 7,889 |
| Mixture of full seed of pearl millet + 25% seed rate of clusterbean                               | 2,354                    | 7,563 | 3,174  | 4,167 | 5,528                | 11,729 | 8,630 |
| Mixture of 75% seed rate of pearl millet + 50% seed rate of greengram                             | 2,979                    | 6,542 | 2,736  | 4,282 | 5,715                | 10,824 | 8,269 |
| Mixture of 75% seed rate of pearl millet + 50% seed rate of cowpea                                | 3,155                    | 7,134 | 3,146  | 4,398 | 6,301                | 11,532 | 8,921 |
| Mixture of 75% seed rate of pearl millet + 50% seed rate of clusterbean                           | 2,412                    | 7,481 | 2,831  | 4,282 | 5,243                | 11,764 | 8,505 |
| Mixture of 75% seed of pearl millet + 25% seed rate each of greengram, cowpea and clusterbean     | 3,560                    | 7,986 | 3,282  | 4,514 | 6,843                | 12,502 | 9,671 |
| Mixture of 50% seed seed of pearl millet + 25% seed seed each of greengram cowpea and clusterbean | 3,523                    | 7,676 | 3,185  | 4,282 | 6,708                | 11,958 | 9,338 |
| CD (P = 0.5)                                                                                      | 543                      | 558   | NS     | NS    | 703                  | 450    |       |
| CV %                                                                                              | 14.02                    | 5.55  | 11.47  | 10.88 | 8.53                 | 6.74   |       |

Rate (Rs/q): Pearl millet grain, 260 and 300; greengram seed, 800 and 1,000; cowpea seed, 550 and 700; clusterbean seed, 400 and 700; and stover, 105 and 100 in 1992 and 1993 respectively

was done with the onset of monsoon in July and harvesting as per maturity of the crops. The recommended seed rate for pearl millet and legumes was 4 and 15 kg/ha respectively. The varieties used were 'MH 179' for pearl millet, 'K 851' for greengram, 'RC 19' for cowpea and 'RGC 197' for clusterbean. The crop was fertilized with 40 kg N/ha and 20 kg  $P_2O_5$ /ha. Half N and full P was applied basal in all rows and half N was top-dressed at 4-week stages of the crops.

## RESULTS AND DISCUSSION

### *Effect on equivalent yield*

A mixture of 75% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean gave the maximum pearl millet-equivalent yield of 1,368 kg/ha and 2,663 kg/ha, which was 68 and 23% higher compared with solid pearl millet during 1992 and 1993 respectively (Table 1). It was followed by mixture of 50% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean (1,356 kg/ha and 2,558 kg/ha during 1992 and 1993 respectively). Similar results were reported by Upadhyay *et al.* (1990) and Rathore (1992).

### *Effect on economic return*

A mixture of 75% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean gave significantly higher economic return of Rs 1,449/ha and Rs 1,493/ha from grain than solid planting of pearl millet during 1992 and 1993 respectively (Table 2). But economic returns from stover did not differ significantly due to different inter- or mixed cropping treatments and solid planting of pearl millet during both

the years. Total economic return was significantly higher (Rs 6,843/ha and Rs 12,502/ha during 1992 and 1993 respectively) under the mixture of 75% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean, followed by mixture of 50% of the recommended seed rate of pearl millet + 25% of the recommended seed rate each of greengram, cowpea and clusterbean (Table 2). Upadhyay *et al.* (1990) reported that a combination of 100% plant population of sorghum and 50% of pigeonpea in the system proved better than other combinations, as the highest sorghum-equivalent yield, net return and land-equivalent ratio were obtained under these treatments. However, Singh *et al.* (1992) reported that sowing of different crops in alternate rows with no fertilizer yielded at par or even more compared with sowing of seed mixture by broadcasting of the same crops with recommended dose of fertilizer.

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