Performance Of Pigeonpea [*Cajanus Cajan* (L.) Millsp.] Varieties Under Broad Bed And Furrow Cultivation At Model Watershed Of Dharwad

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Abstract

A field experiment was conducted during kharif 2012-13 to study the "Performance of pigeonpea varieties under broad bed and furrow cultivation at Model Watershed of Dharwad". The result revealed that broad bed and furrow recorded significantly higher seed yield (1322 kg ha^{-1}) compared to farmer's practice (i.e., flat bed, 1147 kg ha^{-1}). Among the pigeonpea varieties, BSMR-736 recorded significantly higher seed yield (1525 kg ha^{-1}) over rest of the varieties and was followed by TS-3R. The interaction effect, BBF x Varieties i.e., formation of broad bed and furrow along with variety BSMR-736 (BBF x BSMR-736) recorded significantly higher seed yield (1684 kg ha^{-1}) compared to rest of the interactions and was followed by broad bed and furrow along with variety TS-3R (BBF x TS-3R). Significantly lower seed yield was recorded in farmers practice along with variety ICPL-85063 (i.e., FP x ICPL-85063). The broad bed and furrow along with BSMR-736 for higher gross returns (Rs. 60639 ha^{-1}) and net returns (Rs. 40464 ha^{-1}) compared to rest of the interactions.

Key words: *Broad bed and furrow, Pigeonpea varieties.*

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Introduction

Pigeonpea (*Cajanus cajana)* is an important pulse crop of dryland agriculture because of its ability to produce economic yield under limited moisture conditions. Pigeonpea is cultivated worldwide with on area of 4.92 m ha with an annual production of 3.65 m t and productivity is 898 kg ha^{-1}. In India it is grown an area of 0.47 m ha with a production of 30.24 m t with a productivity of 456 kg ha^{-1}. The major portion of pigeonpea growing area is in the states are Maharashtra, Uttar Pradesh, Madhya Pradesh, Karnataka and Gujarat. Andhra Pradesh and Tamilnadu put together they occupy 87.89 per cent of area and contribute 86.10 per cent to the total production. In Karnataka, it occupies an area of 0.60 million hectares with an average yield of 674 kg ha^{-1} (Anon., 2011).

The level of productivity of pulses in India lies between 600-650 kg ha^{-1}, which is far below when compared to average productivity of the world. After 61 years of planned agricultural development, the country is now hereclose to attaining self-sufficiency in pulse production. It has led to the severe shortage of pulses in India, which has aggravated the problem of malnutrition in large section of vegetarian population, since mainly low protein cereals are consumed. Thus, there is an urgent need to increase the production of pulses to meet the increasing demand by manipulating the production technologies appropriately. Pigeonpea is the second most important pulse crop of India after chickpea. The yield of pigeonpea is limited by a number of factors such as agronomic, pathogenic, entomological, genetic and their interaction with environment. Among the different agronomic practices limiting the yield, choice of a suitable moisture conservation practices and particular variety is one of the important factors. Adaptation of proper planting methods to a particular variety will go a long way in making efficient use of limited growth resources and thus to stabilize yield.

Annual rainfall in several parts of dry lands is sufficient for one or more crops per year. Erratic and high intensity storms lead to runoff and erosion. The effective rainfall may be 65 per cent or sometimes less than 50 per cent. Hence, soil management practices have to be tailored to store and conserve as much rainfall as possible by reducing the runoff and increasing storage capacity of soil profile. The simple *in situ* moisture conservation technology developed to prevent or reduce water losses and to increase water intake is the Broad Bed and Furrow (BBF) method. This method is effective on black soils. It plays an important role in reducing the velocity when runoff occurs and increases the infiltration opportunity time and excess water is removed in large number of small furrows and crops are sown on broad beds. In dryland farming areas of Northern Transition Zone of Karnataka, the rainfall is not only scanty but also erratic. Thus, soil moisture becomes the most limiting factor in production of pigeonpea. Therefore, the present investigation was designed to study the performance of pigeonpea varieties under broad bed and furrow cultivation at Model Watershed of Dharwad.

Materials and methods

The field experiment was conducted at farmer's field in Singanahalli village of Dharwad district during *Kharif* 2012. The soil of experimental plot was medium deep black and clay texture having 0.53 per cent organic carbon. The entire quantity recommended dose of fertilizer for pigeonpea (25:50:20:15, N: P_2O_5: $ZnSo_4$ kg ha^{-1}) was applied as basal dose at the time of sowing. The experiments were laid out in split plot design with three replications involving two main plot comprises of different *in situ* moisture conservation practices *viz*., M_1: Broad bed and furrow M_2: farmer's practice and five pigeonpea varieties *viz*., ICPL-87119, ICP-8863, BSMR-736, TS-3R and ICPL-85063 were allotted to subplots. The experimental plots were demarcated as per the plan of layout. Broad bed and furrow plot sowing was done through tropicultor whereas; in case of farmer's practice Furrows were marked with the help of marker at a row spacing of 90 cm. Seeds were dibbled in furrows at an interval of 20 cm and covered with soil. The rainfall during cropping period (July-December) was 436.3 mm which was distributed during crop growth period. The rainfall received in the month of July (112.2 mm), August (90.0 mm), September (89.6 mm) and October (89.2 mm) ensured adequate moisture for germination, emergence and early establishment of seedlings. Five plants were tagged at random in net plot area for recording various yield components like number of pods per plant, number of seeds per pod, seed yield per plant (g), Test weight (g), seed yield (kg ha^{-1}) was computed by threshing pods from net plot, cleaned and seeds weight was recorded. From this seed yield per hectare was computed. The net returns (Rs. ha^{-1}) was calculated by deducting cost of cultivation (Rs. ha^{-1}) from gross returns and B:C was worked out as a ratio of gross returns (Rs. ha^{-1}) to cost of cultivation (Rs. ha^{-1}). Further the adequate quantity and uniform distribution of rainfall ensured proper growth and development of pigeonpea varieties. The data collected from the experiment at different growth stages and at harvest was subjected to statistical analysis as described by Gomez and Gomez (1984). The level of significance used for 'F' and't' test was P = 0.05.

Results And Discussion

Effect of in situ moisture conservation practices

The data on seed yield and stalk yield differed significantly with respect to *in situ* moisture conservation practices. Broad bed and furrow recorded significantly higher seed yield and stalk yield (1322 kg ha^{-1} and 3921 kg ha^{-1}, respectively) compared to farmer's practice. The yield was increased to an extent of 13.24 per cent and 3.39 per cent over farmer's practice. This attribute is might be due to better improvement in moisture content in different soil depths (0-30 cm, 30-45 cm and 45-60 cm) at different growth stages of the crop. This is turn to higher values of seed yield in kg per ha and soil moisture content in 45-60 cm soil profile at 30 DAS (30.67 %), 60 DAS (28.01%), 90 DAS (30.19), 120 DAS (26.72 %), 150 DAS (21.96 %) and at harvest (13.80 %) compared to farmer's practice (Table 1 & Fig. 1). The moisture content was higher to an extent of 23.0, 11.0, 15.73, 10.83, 12.75, and 13.47 per cent at 30, 60, 90, 120,150 DAS and at harvest, respectively over farmer's practice. Higher soil moisture under broad bed and furrow was attributed to reduced runoff, soil erosion and higher infiltration rate in the soil. These results are in agreement with the findings of Mathukia *et al.* (2006) in castor, Robinson *et al.* (1986) in sorghum, Pore and Bhake (1992) and Koraddi *et al.* (1993) in cotton. The increase seed yield may be due to higher soil moisture available for crop growth throughout the growing season, which might have reflected in higher growth parameters *vis-a-vis* higher seed yield, similar results were reported by several research workers in different crops. These results are in accordance with the findings of Tumbare and Bhoite (2000) in Chickpea, Selvaraju *et al* (1999) in sorghum + pigeonpea intercropping system, Pendke *et al.* (2004) in pigeonpea, Hulihalli, (2005) and Muralidaran and Solaimalai (2005) in cotton, Patil *et al*. (1991) in sorghum and Pigeonpea.

Performance of pigeonpea varieties

The data on yield components, seed yield, stalk yield, net returns and B:C ratio are presented in table 2 and 3. The differences in the seed yield differed significantly among the pigeonpea varieties. The seed yield and stalk yield (1525 and 4150 kg ha^{-1}, respectively) produced by variety BSMR-736 was found to be significantly higher than compare to rest of varieties and it was followed by TS-3R (1334 and 3892 kg ha^{-1}, respectively). The extent of reduction in seed yield and stalk yield by TS-3R (12.52 and 6.22 per cent) when compared to BSMR -736. The differences in seed yield by the varieties were reported by Thakur *et al.* (1998). The factors mainly responsible for seed yield variation among varieties is due to the variation in growth and yield components *viz.,* number of pods per plant, pod weight per plant, seed yield per plant and test weight. This may be due to higher number of branches per plant and higher leaf area which determines the photosynthetic ability, growth and dry matter production of a plant. Similarly findings, Thakur *et al.* (1997) and Tej Lal Kashyap *et al.* (2003) reported significant differences in stalk yield of pigeonpea varieties.

Among the yield components, weight of seeds per plant had closer influence on the seed yield per hectare. Significantly higher seed yield per plant was recorded by the genotype, BSMR-736 (49.96 g) than rest of varieties followed by TS-3R (41.66 g). The significantly higher seed yield per plant was probably contributed by significantly higher number of pods per plant (144.17) in BSMR-736 than remaining varieties followed by TS-3R (125.00). These results are in conformity with the earlier findings of Ramesh *et al.* (2006). The test weight of BSMR-736 recorded significantly higher (10.58 g) and it was 3.12 per cent higher than TS-3R (10.25 g). Significantly higher number of pods per plant, pod weight per plant and test weight were observed in variety BSMR-736 followed by TS-3R and it was mainly attributed to its higher efficiency in translocating the photosynthates to the reproductive parts.

Interaction effect

In the present investigation, significantly higher seed yield and stalk yield (1684 & 4367 kg ha$^{-1,}$ respectively) (Table 2) was noticed with formation of broad bed and furrow along with variety BSMR-736 compared to rest of interaction and was followed by broad bend and furrow along with variety TS-3R (1467 kg ha^{-1} and 3933 kg ha^{-1}, respectively). Significantly lower seed yield and stalk yield was observed in farmer's practice along with variety ICPL-85063 (979 & 3667 kg ha^{-1}, respectively). The seed yield in BBF x V_3 was to an extent of 12.89, 18.88, 26.96, 28.62, 33.14, 34.50, 32.60, 37.53 and 41.86 per cent, respectively over BBF x $V_{4,}$ FB x $V_{3,}$ BBF x $V_{1,}$ FB x $V_{4,}$ BBF x V_2, BBF x $V_{5,}$ FB x $V_{1,}$ FB x V_2 and FB x $V_{5,}$ respectively. The increase seed yield is might be due to significantly increase in number of pods per plant (BBF x V_3,), pod weight per plant (BBF x V_3,) and seed yield per plant (BBF x V_3, 201.88g) (Table 2) observed in combination of BBF along with variety BSMR-736. Significant increase due to better response of BSMR-736 variety to improved soil moisture as well as higher nutrient availability resulting in higher uptake of nutrients and contributed to increased seed yield as well as stalk yield.

Economics

The results of the investigation indicated that interaction between broad bed and furrow along with variety BSMR- 736 (BBF x V_3) recorded significantly higher gross returns (Rs. 60639 ha^{-1}) and net returns (Rs. 40464 ha^{-1}) compared to rest of the interactions. This might be due to conservation of more moisture in BBF and higher yield components which resulting in better plant growth producing higher crop yields, gross returns, net returns and B:C ratio. Lower gross returns, net returns and B: C ratio was recorded in the variety sown on farmer's practices (i.e., FB x V_5, Flat bed). This might due to increased competition between the plants for available soil moisture and nutrients which resulted on account for poor growth and insufficient dry matter accumulation reproductive parts leading to lower yields. Similar results are in conformity with the findings of Pendke *et al.* (2004), Mathukia and Khanpara (2006) and Khambalkar *et al.* (2010).

It can be concluded that formation of broad bed and furrow along with pigeonpea variety BSMR-736 superior with respect to branching and podding and resulted significantly higher seed yield and stalk yield compared to rest of the varieties which was feasible and advocated to rainfed farmers of Northern Transition Zone of Karnataka.

Fig. 1: Soil moisture content (%) as influenced by pigeonpea varieties and *in situ* moisture conservation practices on 45-60 cm soil depth

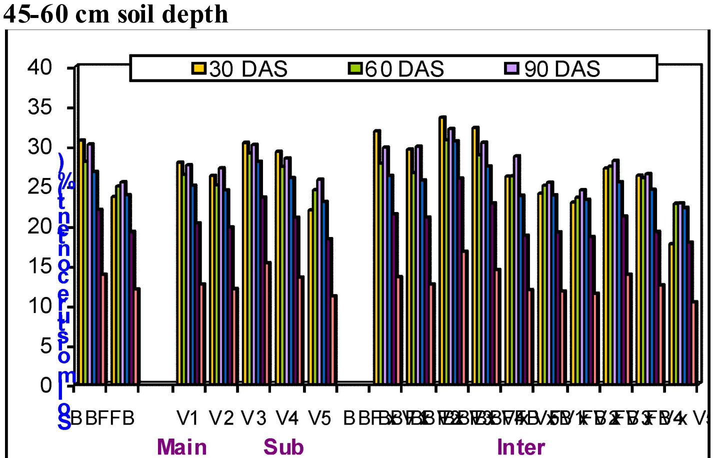

Fig. 1: Soil moisture content (%) as influenced by

References

Anonymous, 2011, Annu. Rep., Directorate of statistics and economics, Government of India.

Arjun Sharma and Guled, M. B., 2012, Effect of set- furrow cultivation in pigeonpea + green gram intercropping system in medium deep black soil under rainfed conditions. Karnataka J. Agric. Sci., ***25*** *(1) : 18-24.*

Arjun sharma, Pandit Rathod, S. and Basavaraj, K., 2010, Agronomic management of pigeonpea (Cajanus cajana) based intercropping systems for improving productivity under rainfed conditions. Karnataka J. Agric. Sci., ***23*** *(4): 570-574.*

Giramallappa, B. T., Koppalkar, B. G., Halepyati, A. S. and Desai, B. K., 2012, Yield and economics of pigeonpea genotypes as influenced by planting geometry under rainfed condition. Karnataka J. Agric. Sci., ***25*** *(2): 179-182.*

Gomez, K. A. and Gomez, A. A., 1984, Statistical procedures for agricultural research 2nd Edition, A Wiley Inter Science Publications, New York, USA.

Hulihalli, U. K., 2005, Studies on in-situ moisture, conservation and integrated nutrient management practices in rainfed herbaceum cotton. Ph. D. Thesis, Uni. Agric. Sci., Dharwad.

Khambalkar, V. P., Nage1, S. M., Rathod, C. M., Gajakos, A. V. and Shilpa Dahatonde, 2010, Mechanical sowing of safflower on broad and bed furrow. Australian J. Agril. Engg. ***1****(5):184-187.*

Koraddi, V. R., Modak, S. B., Gyggari, A. K. and Kamath, K. S., 1993, Studies on efficient utilization of rainwater and soil moisture in rainfed cotton. J. Maharashtra Agric. Uni., 18 (1) : 27-29.

Mathukia, R. K. and Khanpara, V. D., 2006, Evaluation of in situ moisture conservation practices and zinc fertilization for rainfed castor (Ricinus communis L.). International J. Agril. Sci., ***2*** *(2): 608-609.*

Muralidaran, C. and Solaimalai, A., 2005, Studies on land configuration methods, row spacing and time of nitrogen application on nutrient uptake and yield of cotton in dryland condition of western zone of Tamil Nadu. Karnataka J. Agric. Sci., ***18****(1): 1.3.*

Patil, S. N., Muzumar, G. K. and Pore, D. B., 1991, Effect of moisture conservation measures on growth and yield of sorghum-pigeonpea intercropping in watershed area. Indian J. Soil Conserv., ***19*** *(1 & 2): 6-12.*

Pendke, M. S., Lomte, M. H. and Gitte, A. U., 2004, Effect of soil and water conservation practices on runoff, soil loss and yield of pigeonpea. J. Maharashtra Agric. Univ., ***29****(3): 319-321.*

Pore, D. B. and Bhake, R. M., 1992, Effect of land treatment on moisture conservation and its effect on growth and yield of cotton (cv. PKV-2). PKV Res. J., ***16****: 263-264.*

Pramod, G., Pujari, B. T., Basavaraja, M. K., vijay, M. and venkate, G., 2010, Yield, yield parameters and economics of pigeonpea (Cajanus cajan (L.) Millsp) as influenced by genotypes, planting geometry and protective irrigation. International Journal of Agricultural Sciences, ***6*** *(2) : 422-425.*

Prashanthi, L., Vasanthi, R. P. and Muneendra Babu., 2001, Evaluation of pigeonpea genotypes for rainfed conditions in the Southern Zone of Andhra Pradesh, India. Int. Chickpea and Pigeonpea Newslett., pp. 50-52.

*Ramesh, P., Mohan Singh, Panwar, N. R., Singh, A. B. and Ramana, S., 2006, Response of pigeonpea varieties to organic manures and their influence on fertility and enzyme activity of soil. Indian J. Agric Sci., 7**6** (4): 251-254.*

*Robinson, J G., Balasubramanian, T. N. and Ravikumar, V., 1986, Effect of different soil moisture conservation systems on the yield of sorghum (CSH 6) in rainfed vertisols. Madras Agric. J., 7**3**(5) : 255-258.*

Selvaraju, R., Subbian, P., Balsubramanian, P. and Lal, R., 1999, Land configuration and soil nutrient management options for sustainable crop production on Alfisols and vertisols of southern peninsular India. Soil and Tillage Res., ***52*** *(3-4): 203-216.*

Tej Lal Kashyap, Shrivastava, G. K., Lakpale, R. and Choubey, N. K., 2003, Productive potential of pigeonpea genotypes in response to growth regulator under vertisols of Chatisgarh plains. Ann. Agric. Res. New Series, ***24****(2): 449-452.*

Thakur, H. S., Sinha, N. K. and Raghuwanshi, R. K. S., 1997, Varietal performance of pigeonpea in medium black soils of Madhya Pradesh. Crop Res., ***13*** *(1) : 41- 43.*

Thakur, H. S., Sinha, N. K. and Sharma, S. N., 1998, Response of pigeonpea to plant population and fertility levels under Malwa conditions. Indian J. Agron., ***43*** *(3) : 444 - 447.*

Tumbare, A. D. and Bhoite, S. U., 2003, Effect of moisture conservation techniques on growth and yield of pearl millet- chickpea cropping sequence in a watershed, Indian J. Agric. Res. Dev., ***18*** *(2) : 149-151.*