Environment & Ecology 35 (2) : 778—780, April—June 2017
Website: environmentandecology.com ISSN 0970-0420

Mechanization of Intercultural Operations in Pearl Millet [(*Pennisetum glaucum* (L.) R]

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Received 2 June 2016; Accepted 5 July 2016; Published online 26 July 2016

Abstract Traditional hand weeding is the most effeicent and widely adopted paractice of weed management but it it is labor intensive, time consuming and not economical due to high wages rate and hence present experiment on mechanization was conducted on pearl millet in light textured soils to evaluate the effectiveness of mechanical intercultural operations during *kharif* of 2013. The experiment was laid out in split- plot design with three replications. The treatments were comprised of three mechanized intercultural operations (25-30 DAS) i.e. tractor, kasola, and wheel hand hoe in the main plot and two row spacings (45 cm and paired row (30:70) in the sub plot. The test hybrid was HHB-234. Mechanized interculture with tractor at both the row spacings (45 cm and paired row 30:70 cm) gave lowest weed intensity/m^2 and highest net returns (Rs 9,273/ha and Rs 9,360/ha, respectively and benefit: cost ratio (1.34 and 1.34, respectively) over other recommended intercultural practices (kasola and wheel hand hoe).

Keywords Pearl millet, Kasola, Variety, Mechanized weed management.

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Introduction

Aricultural mechanization is an important link for sustainable agriculture and rural development [1]. The application of modern implements and machineries for the crop production over the traditional practices reduces the cost of production which surely impact on the crop production and the net income of the farmers [2]. Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is the world's hardiest warm season cereal crop. It can survive even on the poorest soils in the driest regions, on highly saline soils and in the hottest climates. Pearl millet is the fourth most important crop following rice, wheat and sorghum in India, and cultivated on an area of 7.95 m ha with production of 8.79 mt and productivity 1106 kg/ha, respectively. In Haryana, it is cultivated on 0.411 m ha with a production of 0.785 m tones and average productivity of 1910 kg/ha [3] and 90% of its cultivation is mainly confined to eight district6s of S-W Haryana. Pearl millet besides being good source of protein (12%), fat (5%) carbohydrates (65%), is the richest source of minerals (2-3%) and low in crude fiber. It is an important food and fodder ingredient of both human and livestock population Agricultural mechanization is an important input to agriculture for performing timely farm operations ; reducing the cost of operation; maximizing the utilization efficiency of costly inputs (seeds, fertilizer, plant protection chemicals, water and agricultural machinery); reducing drudgery in farm operation; improving the productivity of land & labor and for improving the dignity of labor [4] . In South-West zone Haryana farmers used to cultivate pearl millet on light textured soils having poor water reten-

tion capacity during *kharif* season. Moisture conservation is key for achieving high yields in drylands as crops are grown under limited moisture conditions. Weeds problem is more serious in *kharif* season than *rabi* due to rainfall which is more congenial for weeds. In majority of dryland regions.Weeds compete with crop plants for light, moisture, nutrients, space and caused reduction in grain yield of pearl millet to the tune of 10-50% (depending upon the intensity of weeds and timing of weeding) resulted into low economic returns. Weed competition is critical during 25 to 30 days after sowing in pearl millet. It is very important in today's concern that cost of cultivation is increasing day by day. The 33% cost of cultivation is spent on weeding alone whean carried out with the manual labor. The farmers are, therefore, concerned about reducing the cost of cultivation and getting high returns. Effective and timely weed control in pearl millet crop plays a very important role in improving crop productivity. Conventionally farmers use hand tools like wheel hand hoe, kasola, wooden hoe, bullock drawn blade which covers less area per day and is labor intensive. This leads to prolonged opertions leaving weeds in the field for longer, depleting soil resources [5]. Weeds can cause yield loss of 40% in pearl millet cause If future food needs are to be met without further degrading the limited agricultural resource base, it seems mandatory to use techniques that give sustainable yield increases. Appropriate agro-techniques are necessary to realize profitable yields from pearl millet. Mechanized intercultural is also an important tool (to control weeds in reducing cost of cultivation and getting high benefits. Therefore, the present investigation was carried out to found the feasibility of mechanized interculture with tractor in comparison to recommended manual practices with kasola and wheel hand hocein pearl millet under semi-arid climatic conditions of S-W Haryana with following objectives to study the effect of mechanized intercultural operations in comparison to recommended practices o yield and yield attributing characters of pearl millet under varying row spacing and to work out the economics of different treatments.

Materials and Methods

A field experiment was carried out in light textured soils of the Research Farm, CCS HAU, RRS, Bawal during *kharif* of 2013. The climate of the region is classified as tropical steppe, semiarid and hot, mainly dry with prolonged hot period from March to October and fairly cool winters. The experimental soil was loamy sand in texture having pH (1:2) 8.34, EC (1 :2) 0.2 dsm^{-1}, organic carbon 0.19%, available P 11.34 kg/ha available K 180 kg /ha. The crop was raised with standard package of practices recommended by directorate of extension education, CCS, Haryana Agricultural University. Hisar. The variety of pearl millet was HHB-234. The crops was sown on mid July and was harvested on 25th September. The first intercultivation was done about two weeks after sowing and the second and the third about a fortnight and a week later. The experiment was laid out in Randomized block design and six treatment combinations were replicated thrice. The treatments were comprised of three intercultural operations (25-30 DAS) i.e. tractor, kasola, and Wheel hand hoe incombinations of two row spacing (45 cm and 30: 70 cm paired row. To record the yield attributing characters of both the crops three plants per plot were tagged and the seed as well as biological yield harvested per plot was converted in to kg/ha basis. The economics of different treatments was calculated by using the data provided by the department of economics, CCS, Haryana Agricultural University, Hisar and the MSP recommended by the ministry of agriculture, India.

Results and Discussion

Two main weeds found under trial were *Trianthema portulacastrum* and *Dactyloctenium aegyotium.* The data exhibited that recommended intercultural practices with Kasola (23.60 q/ha and 23.55 g/ha)or Wheel hand hoe (23.40 q/ha and 23.48 q/ha) at 25-30 DAS in pearl millet sown at 45 cm row spacing and 30:70 paired row spacing gave statistically equal grain yield to mechanized interculture with tractor (22.50 q/ha and 22.56 q/ha) (Table 1). Mechanized interculture with tractor at both the row spacing (45 cm and paired row 30: 70 cm) gave highest net monetary returns (Rs 9,273/ha and Rs 9,360/ha, respectively and benefit: cost ratio (1.34 and 1.34, respectively) over other recommended intercultural practices [Kasola (Rs 6,719 and Rs 6,436) and Wheel hand hoe (Rs 7,592 and Rs 7,698)]. Recommended intercultural practices with Kasola or Wheel hand in pearl millet sown at 45 cm

Table 1. Effect of mechanized and manual intercultural practices on the weed intensity, grain yield (q/ha) and economics of pearl millet. Maket price peari millet (grain Rs 1,200/q and Stover Rs 150/q).

Treatments	Weed intensity at harvest/m^2	Grain yield (q/ha)	Stover yield (q/ha)	Net returns	B : C ratio
Sowing at 45 cm row spacing & Interculture with Kosola	13.0	23.60	60.65	6719	(1.21)
Sowing at 45 cm row spacing & Interculture with Wheel hand hoe	15.0	23.40	59.56	7592	(1.25)
Sowing at 45 cm row spacing & Interculture with Tractor	19.0	22.50	57.30	9273	(1.34)
Sowing at 30 :70 cm paired row spacing & Interculture with Kasola	13.3	23.55	58.09	6436	(1.20)
Sowing at 30 :70 cm paired row spacing & Interculture with Wheel hand hoe	15.1	23.48	58.00	7698	(1.25)
Sowing at 30:70 cm paired row spacing & Interculture with Tractor	20.0	22.56	56.12	9360	(1.34)
CD (p = 0.05)	-	NS	NS	-	-

row spacing and 30:70 paired row spacing gave statistically equal grain yield to mechanized intercultural with tractor. The weed intensity at harvest under all treatments was almost similar. Hence interculture with tractor is better than manual weeding due to high net returns and B:C ratio under interculture with tractor. We can conclude that Mechanized intercultural with tractor can be an effective alternate of labor for controlling weeds in pearl millet.

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