

Growth and Productivity of Wheat under Eucalyptus Tereticornis based Agroforestry System

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Abstract-A field experiment was conducted during winter season of 2016-17 to find out the growth and yield of for wheat (*Triticum aestivum* L.) crop with weed control method under eucalyptus based agroforestry system. An experiment was conducted at the farmer field village- Majitha, District-Jabalpur during the rabi season of 2016-17. Treatments consisted of 10 weed control treatments [2, 4-D @ 0.5 l ha⁻¹, Metribuzin @ 0.250 Kg ha⁻¹, Butachlore @ 1 l ha⁻¹, Chlodinofof-propezylye 0.140 gm ha⁻¹, 2, 4-D @ 0.5 l ha⁻¹ + @ 0.250 Kg ha⁻¹ + Butachlore @ 1 l ha⁻¹, Metribuzin @ 0.250 Kg ha⁻¹ + Butachlore @ 1 l ha⁻¹, Hand weeding 30 DAS + 2, 4-D @ 0.5, Hand Weeding 30 DAS and Weedy check] laid out in randomized block design with three replication. The result revealed that maximum plant height and number of tillers per meter row length number of effective tillers per meter row length, length of ear head, 1000 grain weight, grain yield, straw yield and harvest index was recorded under hand weeding -30 DAS. Whereas, lowest plant height and number of tillers per meter row length number of effective tillers per meter row length, length of ear head, 1000 grain weight, grain yield, straw yield and harvest index were recorded under weedy check. Amongst chemical weed control treatments, the Chlodinofof-propezylye 0.140 gm ha⁻¹ recorded higher plant height and number of tillers per meter row length, number of effective tillers per meter row length, length of ear head, 1000 grain weight, grain yield, straw yield and harvest index followed by by Hand weeding 30 DAS + 2, 4-D @ 0.5 l ha⁻¹, Metribuzin @ 0.250 Kg ha⁻¹, 2, 4-D @ 0.5 l ha⁻¹ under eucalyptus based agroforestry system.

Keyword: *Eucalyptus tereticornis*, *Wheat*, *Agroforestry*, *Growth*, *Crop yield*, *Harvest index*.

I. INTRODUCTION

Eucalyptus tereticornis commonly known as 'red gum' is native of Australia and Papua New Guinea. It is one of the most widely planted exotic species that has been extended to other parts of the globe. It has been promoted in many tropical countries owing to its fast growth rate, adaptability to wider climatic and edaphic conditions and multiple uses (Zobel et al., 1987; Evans, 1992). Agroforestry is one of the best option to increase the tree cover outside the forest. The need of agroforestry has been necessitated in many parts of the country, which face several agricultural and ecological problems, predominant of which are soil degradation, large scale deforestation, increasing population pressure of human beings and livestock, and decreasing land:man ratio. Intercropping, especially during the tree gestation period, could be

economically profitable and is environmentally sound indeed. Trees on farm can be made popular, especially fast growing like eucalypts which also provide fodder, fuel and timber. Thus keeping in view multipurpose uses and role in bio-drainage eucalypts plantation is likely to be adopted on large scale on government and private lands. (Kumar et al., 2013)

Wheat (*Triticum aestivum* L.) is widely intercropped cereal crop during rabi season (November-April) with *Eucalyptus*, Poplar, and other fast growing tree species in Northern states of India viz., Uttarakhand, Punjab, Haryana, Uttar Pradesh and Bihar, parts of Central and Eastern states such as Madhya Pradesh, Chhattisgarh and West Bengal. *Eucalyptus* is the most successful fast growing, industrial agroforestry tree species in India with extremely high productivity up to 10-30 m³ha⁻¹yr⁻¹. Intercropping with high density short rotation tree species is the best option to meet the increasing food and industrial raw material requirement through sustainable utilization of natural resources (Sarvade et al., 2014).

Ecologically, wheat is adapted to a variety of climates and stressed environments including salinity. However, different biotic and abiotic stresses cause reduction in grain yield to various extents depending upon their nature and intensity. In agroforestry systems, reduction in yield of wheat is generally observed under the shade of tree crown and weeds due to resource competition (Puri and Bangarwa, 1992 and Awan et al., 2015). Therefore, the present study was conducted to assess the growth and yield performance of wheat with weed management practices under eucalypts based agroforestry system.

II. PREVIOUS WORK

Amare et al., (2014) reported that highest grain yield (2289.4 kg ha⁻¹) was recorded in hand weeding followed by post emergent isoproturon at 1.5 kg ha⁻¹ (2177.3 kg ha⁻¹). The highest straw yield was recorded in hand weeding followed by isoproturon 1.50 kg ha⁻¹, and harvest index was also maximum with hand weeding.

Pisal and Sagarka (2013) reported that weed free treatment recorded significant improvement in yield attributes, viz. number of effective tillers, spikelets per spike and grain weight per plant, followed by pendimethalin 0.9 kg/ha as pre-emergence followed by one hand weeding at 35- 40

DAS. All the weed control treatments significantly influenced the grain and straw yield of wheat excluding unweeded control.

Kumar et al., (2013) reported that the height of wheat and mustard was significantly less under agri-silviculture system as compared to sole cropping. The other parameters such as plants per running meter row length (161.7), spike length (7.7 cm), grains per spike (37.7) and test weight (26.7g) were significantly less under Eucalyptus than in sole cropping. The grain and straw/stover yields of both the crops under Eucalyptus decreased significantly as compared to sole cropping. Grain yield reduction (63.2%) was less in wheat.

III. MATERIAL AND METHODS

The field experiment was conducted at farmer's field at Village - Majitha, Block – Shahpura, District - Jabalpur during Rabi season 2016 -17. Jabalpur is situated at 23°9' North latitude and 79°58' East longitudes with an altitude of 411.78 meters above the mean sea level. The climate of the locality is characterized as typically semi-humid and tropical, which is featured by hot dry summer and cool dry winter. It is classified as "Kymore Plateau and Satpura Hills" agro-climate zone, as per norm of National Agricultural Research Project and is broadly known as rice-wheat crop zone of Madhya Pradesh. During the growing season of crop (Nov to April, 2016-17). The experiment was laid out in randomized block design with three replications and consisted of ten weed control treatment [2, 4-D @ 0.5 l ha⁻¹, Metribuzin @0.250 Kg ha⁻¹, Butachlore @ 1 l ha⁻¹, Chlodinofof-propezylye 0.160 kg ha⁻¹, 2, 4-D 0.5 l ha⁻¹ + Metribuzin @0.250 Kg ha⁻¹, 2, 4-D @ 0.5 l ha⁻¹ + Butachlore @ 1 l ha⁻¹, Metribuzin@0.250 Kg ha⁻¹ + Butachlore @ 1 l ha⁻¹, Hand weeding 30 DAS + 2, 4-D @ 0.5 l ha⁻¹, Hand Weeding 30 DAS, Weedy check]. Wheat variety LOK-1 was sown with 25 cm row spacing at a depth of 4 cm from the top of the soil by opening furrows through a Kudal. The observations on crop growth, yield attributes and yield were recorded in all the treatments at the time of harvest. Harvest index was calculated as the ratio of grain yield to the biological yield. All the experimental data were statistically analyzed and critical difference (CD) was worked out by the procedure as described by Gomez and Gomez (1984).

IV. RESULT AND DISCUSSION

Growth Parameter,

The results indicated that growth parameters such as plant height, number of tillers/plant of wheat crop were significantly influenced by weed control treatments. Maximum plant height and number of tillers per meter row length was recorded in hand weeding 30 DAS (71.80 cm and 78.00) as compared to all other treatments. Among the

chemical weed control treatment Chlodinofof-propezylye 0.160 kg ha⁻¹ recorded higher plant height and number of tillers per meter row length (70.17 cm and 75.00) followed by Hand weeding 30 DAS + 2, 4-D @ 0.5 l ha⁻¹ (70.03 cm and 74.51), Metribuzin @0.250 Kg ha⁻¹ (69.87 cm and 74.17), 2, 4-D @ 0.5 l ha⁻¹ (69.33 cm and 73.67), 2, 4-D @ 0.5 l ha⁻¹ + Metribuzin @0.250 Kg ha⁻¹ (69.00 cm and 73.20) respectively. The weedy check recorded significantly lower plant height and number of tillers per meter row length (64.7 cm, 66.33) at par with Butachlore @ 1 l ha⁻¹ (65.33, and 70.00) in all the treatment (Table 1). The reason for higher values of growth parameter in hand weeding can be discussed in the light of fact that crop under eucalyptus plantation with these treatments had comparatively less weed competition for nutrient, moisture, space, light and thereby more availability of these resources than other treatments which resulted in better crop growth. (Varma et al., 2013)

Yield and Yield Attributes,

The result showed that maximum number of effective tillers per meter row length, length of ear head and 1000 grain weight was recorded under hand weeding -30 DAS (74.67, 6.73 cm, 31.33 gm) as compared to all other treatments. Among the chemical weed control treatments, Chlodinofof-propezylye 0.160 kg ha⁻¹ (70.33, 6.00 cm, 28.33 gm) recorded maximum number of effective tillers per meter row length, length of ear head and 1000 grain weight followed by Hand weeding 30 DAS + 2, 4-D @ 0.5 l ha⁻¹, (70.00, 5.80 cm, 27.67 gm), Metribuzin @0.250 Kg ha⁻¹ (69.33, 5.73 cm, 27.50 gm), 2, 4-D @ 0.5 l ha⁻¹ (68.67, 5.50 cm, 26.83 gm), 2, 4-D @ 0.5 l ha⁻¹ + Metribuzin @0.250 Kg ha⁻¹ (26.50, 5.58 cm, 26.50 gm) respectively. The weedy check recorded significantly lower number of effective tillers per meter row length, length of ear head and 1000 grain weight (58.33, 4.47 cm, 22.60 gm) respectively. (Table No 1).

The grain yield and straw yield of wheat was highest in the hand weeding- 30 DAS plots (19.75 qha⁻¹ and 46.54 qha⁻¹), Among the chemical weed control treatment Chlodinofof-propezylye (17.63, qha⁻¹ and 41.36 qha⁻¹) at par with Hand weeding 30 DAS + 2, 4-D @ 0.5 l ha⁻¹ (17.19 qha⁻¹ and 40.22 qha⁻¹), Metribuzin @0.250 Kg ha⁻¹ (17.04 qha⁻¹ and 40.10 qha⁻¹) and 2, 4-D @ 0.5 l ha⁻¹ (16.67 qha⁻¹ and 39.92 qha⁻¹) respectively. The harvest index was higher in Hand weeding + 2, 4-D (30 DAS + 0.5 l ha⁻¹) 29.95 % followed by all other weed control treatments. The weedy check recorded significantly lower grain yield, straw yield and harvest index of wheat (12.04 qha⁻¹, 34.29 qha⁻¹, 26.04 %) under eucalyptus based agroforestry system (Table 2). The yield reduction in weedy check plot over hand weeding is 33.82% under eucalyptus based agroforestry system.

Table 1: Yield Attributing Character of Wheat As Influenced By Different Treatments Under Agroforestry System.

Treatment		Growth stages of wheat 2016-17				
		Plant height AtHarvest	No of tillers/ MRL	No of effective tillers/ MRL	Length of ear head (cm)	1000 grain weight (g)
T ₁	2, 4-D @ 0.5 l ha ⁻¹	69.33	73.67	68.67	5.50	26.83
T ₂	Metribuzin @0.250 Kg ha ⁻¹	69.87	74.17	69.33	5.73	27.50
T ₃	Butachlore @ 1 l ha ⁻¹	65.33	70.00	67.33	4.93	23.82
T ₄	Chlodinofofpropezyle	70.17	75.00	70.33	6.00	28.33
T ₅	2, 4-D + Metribuzin (0.5 l ha ⁻¹ +0.250 Kg ha ⁻¹)	69.00	73.20	69.00	5.58	26.50
T ₆	2, 4-D + Butachlore (0.5 l ha ⁻¹ +1 l ha ⁻¹)	67.67	72.67	64.00	5.23	24.30
T ₇	Metribuzin +Butachlore (0.250 Kg ha ⁻¹ +1 l ha ⁻¹)	66.67	71.33	62.67	5.13	25.17
T ₈	Hand weeding + 2, 4-D (30 DAS + 0.5 l ha ⁻¹)	70.03	74.51	70.00	5.80	27.67
T ₉	Hand Weeding (30 DAS)	71.77	78.00	74.67	6.73	31.33
T ₁₀	Weedy check	64.67	66.33	58.33	4.47	22.60
	SEm±	0.53	0.64	0.81	0.14	0.91
	CD (P=0.05)	1.54	1.87	2.36	0.41	2.67

Table 2: Grain yield, straw yield and harvest index of wheat as influenced by different treatments under Agroforestry system.

Treatment		Grain Yield (q ha ⁻¹)	Straw Yield (q ha ⁻¹)	Harvest Index (%)
T ₁	2, 4-D @ 0.5 l ha ⁻¹	16.67	39.92	29.45
T ₂	Metribuzin @0.250 Kg ha ⁻¹	17.04	40.10	29.83
T ₃	Butachlore @ 1 l ha ⁻¹	13.97	35.41	28.27
T ₄	Chlodinofof-propezyle	17.63	41.36	29.89
T ₅	2, 4-D + Metribuzin (0.5 l ha ⁻¹ +0.250 Kg ha ⁻¹)	15.84	38.82	28.97
T ₆	2, 4-D + Butachlore (0.5 l ha ⁻¹ +1 l ha ⁻¹)	15.27	37.67	28.84
T ₇	Metribuzin +Butachlore (0.250 Kg ha ⁻¹ +1 l ha ⁻¹)	15.00	36.50	29.14
T ₈	Hand weeding + 2, 4-D (30 DAS + 0.5 l ha ⁻¹)	17.19	40.22	29.95
T ₉	Hand Weeding (30 DAS)	19.75	46.54	29.80
T ₁₀	Weedy check	13.07	34.99	27.23
	SEm±	0.42	0.82	0.71
	CD (P=0.05)	1.23	2.39	2.08

V. CONCLUSION

The experiment concluded that the Growth and yield parameters of wheat were lower in weedy check plot. Whereas, hand weeding under eucalyptus plantation provide higher Growth and yield of wheat crop than the other weed management practices. Among different weedicide treatment Chlodinofof-propezyle @160 gm

ha⁻¹ is provide maximum Growth and yield followed by Hand weeding + 2, 4-D, Metribuzin @0.250 Kg ha⁻¹, 2, 4-D @ 0.5 l ha⁻¹ under wheat and eucalyptus based agroforestry system. The 33.82% yield reduced under weedy check plot than the hand weeding under eucalyptus based agroforestry system.

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