Efficacy of pre and post emergence herbicides with cultural practices on weeds, productivity and profitability in turmeric (Curcuma longa L.)

SU Kakade, JP Deshmukh, ND Parlwar, MS Solanke and SS Thakare

Abstract

The field experiment was conducted at AICRP Weed Management field, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during three consecutive Kharif season of the year 2015-2016, 2016-17 and 2017-18. The experiment was laid out in Randomized Block Design with three replication having fourteen different treatments to study the bio-efficacy of pre and post emergence herbicides with cultural practices on weed control, growth and productivity of turmeric. The results revealed that all the weed control treatments significantly reduced the weed population and weed biomass when compared with unweeded control. The hand weeding (25, 45 and 75 DAP) recorded significantly lower weed count, dry matter accumulation and WCE of 94.45% followed by integrated weed management treatments of metribuzin 0.7 kg/ha PE followed by straw mulch 10 t/ha fb one HW which recorded lowest weed population and weed dry weight at harvest and WCE of 58.35%. Lower weed index value (3.41) was associated with the treatments Pendimethalin 1 kg/ha (0-5 DAP) fb straw mulch 10 t / ha (10 DAP) fb one HW (75 DAP), Integrated weed management practices resulted in increase of rhizome yield over the weedy check. Maximum rhizome yield was observed in weed free treatment (22.51 t/ha), while among the IWM treatments application of pendimethalin 1.0 kg/ha (0-5 DAP) fb straw mulch 10 t / ha (10 DAP) fb one HW recorded highest rhizome yield (21.72 t/ha) which was closely followed by metribuzin 0.7 kg / ha fb straw mulch (10 DAP) fb HW (21.60 t/ha) and atrazine 0.75 kg / ha (0-5 DAP) fb straw mulch (10 DAP) fb HW (21.37 t/ha) being par with each other. Due to higher rhizome yield, highest monetary returns of Rs. 277024 /ha was registered under pendimethalin 1 kg/ha (0-5 DAP) fb straw mulch 10 t / ha fb one HW with B: C ratio of 4.20 highest than 3 HW at 25, 45 and 75 DAP. (3.35). The findings of present investigation conclusively inferred that, integrated use of either Pendimethalin 1 kg/ha or by Metribuzin 0.7 kg / ha (0-5 DAP) fb straw mulch 10 t / ha (10 DAP) fb one HW (75 DAP) as adjudged very effective for weed control and for attaining the highest productivity and profitability in turmeric.

Keywords: Atrazine, economics, metribuzin, pendimethalin, turmeric, weed

Introduction

Turmeric (Curcuma longa L.), a herbaceous perennial important spice crop grown in India in an area of more than 1.50 lakh hectares with a production of about 5.27 million tonnes. Turmeric is a crop of warm-humid climate native of South Asia, particularly India (Mannikeri, 2006) [10]. Though, India leads in production of turmeric with 78% of global production, its average productivity is quite low, mainly due to the competition offered by weeds. The successful cultivation of the crop mainly depends upon weed management as the loss due to weed is estimated to be 30 to 75 per cent owing to delayed emergence, slow initial growth, poor crop canopy development and long duration (Krishnamurty and Ayyaswamy, 2000) [7]. Turmeric is a long duration crop. Delayed emergence, slow initial growth of the crop and ample land space available due to wider spacing permit more sunlight to reach the soil resulting conducive environment for rapid weed growth and enormous damage to crop yield (Sathiyavani and Prabhakaran, 2015) [12]. Turmeric is a long duration crop (more than 280 days), therefore pre-emergence application of herbicides alone does not control weeds throughout critical crop weed competition period of the crop and needs an integration of post-emergence application of herbicides or intercultural operation and application of straw mulch in combination with pre-emergence herbicide application. Generally for the control of weeds, farmers do manual weeding, but with increase in labour cost and scarcity of labour, manual weed control has become a difficult task. Mulching with straw is another approach adopted by the farmers that conserves soil moisture and maintains soil temperature for the benefit of the crop (Mahey et al., 1986) [14], besides suppressing weeds. Conventional weed management practices are costly, unavailable in time and exhaustive due to different back pulling reasons especially in transplanted turmeric.
The experiment was laid out in a Randomized Block Design replicated thrice having fourteen different chemical and integrated weed management treatments compared with cultural weed management and unweeded check. The treatments were, Metribuzin 0.7 kg / ha (0-5 DAP) fb 2 hand weeding, Metribuzin 0.7 kg / ha (0-5 DAP) fb fenoxaprop + metsulfuron (67+ 4 g / ha) POE, Metribuzin 0.7 kg / ha (0-5 DAP) fb straw mulch fb HW (75 DAP), Metribuzin 0.7 kg / ha (0-5 DAP) fb straw mulch fb HW (75 DAP), Pendimethalin 1.0 kg / ha (0-5 DAP) fb 2 HW, Pendimethalin 1.0 kg / ha (0-5 DAP) fbfenoxaprop + metsulfuron (67+ 4 g / ha) POE, Pendimethalin 1.0 kg/ha (0-5 DAP) fb straw mulch 10 t / ha fb one HW, Atrazine 0.75 kg/ha (0-5 DAP) fb two HW, Atrazine 0.75 kg/ha (0-5 DAP) fbfenoxaprop + metsulfuron (67+ 4 g / ha) POE, Atrazine 0.75 kg/ha (0-5 DAP) fb straw mulch 10 t / ha fb one HW, Oxylufluorenb two HW, Oxadiargyl 0.25 kg/ha (0-5 DAP) fbtwo HW, Glyphosate fb 2 HW, Hand weeding (25, 45 & 75 DAP) and Unweeded check. The soil of the experimental field was black and clayey in texture and slightly alkaline in reaction, low in nitrogen, medium in phosphorous and fairly rich in potash. The turmeric variety PDKV Waigaon was planted was planted on raised bed at the spacing of 45 x 22.5 cm on 23rd June 2015, 27th June, 2016 and 13th July 2017 and the crop was harvested on 29th January 2016, 28th January 2017 and 15th February, 2018. The recommended dose of fertilizer was 200:100:100 Kg NPK /ha with 10 tons of FYM/ha applied before the planting of turmeric. The herbicides were applied as per the treatments with knapsack sprayer with flat fan nozzle using a spray volume of 700 liters/ha for pre emergence and 500 liters/ha for post emergence spray. The observations on weed density and weed biomass were taken at 30 days interval upto harvest from four randomly selected spots by using a quadrat of 50 cm x 50 cm quadrat. The entire weeds inside the quadrat were uprooted and cut close to the transition of root and shoot in each plot and collected for dry matter accumulation. Then weeds were grouped as monocot species and dicot species. The samples were first dried in sun and kept in oven at 70 +2°C. The dried samples were weighed and expressed as dry biomass (g/m²).
rhizomes, because more photosynthates were transferred from above ground parts. Mulch proved to be the extremely important practice as the treatments constituting the straw mulch viz. pendimethalin/metribuzin/atrazine fb mulch fb hoeing resulted in significantly higher fresh rhizome yield over other treatments. Swain et al. (2007) also reported significantly higher fresh weight of rhizome per plant with application of paddy straw mulch as compared to no mulch. Weeds in unweeded check reduced the rhizome yield by 61.88% over the best treatment i.e. three hand weedicings and 60.49%, 60.27% and 59.85% pendimethalin/metribuzin/atrazine fb straw mulch fb hoeing. Pendimethalin/Metribuzin/atrazine fb mulch fb hoeing increased fresh rhizome yield by 2.5 times over weedy check. The lowest yield values were recorded with weedy check. (8.58 t/ha). Similar results were also reported by Jadhav and Pawar (2014).

Economics of weed control
As indicated in Table 2, all the weed control treatments tended to significantly surpass weedy check in terms of gross returns, net returns and B:C ratio. Although, weed free i.e three hand weedicings recorded the maximum rhizome yield, maximum gross monetary returns of Rs. 378131/ha, however maximum net monetary returns of Rs. 277024 /ha was registered under pendimethalin 1.0 kg/ha (0-5 DAP) fb straw mulch 10 t / ha fb one HW with B: C ratio of 4.20 followed by metribuzin 0.7 kg / ha fb straw mulch (10 DAP) fb HW with NMR of Rs.273294 and B: C ratio of 4.05 highest than the Hand weeding (25, 45 & 75 DAP) (3.35). This might be due to the higher cost of maintaining weed free environment (hand weeding three times) resulted in lower B:C ratio than integrated methods. Though the cultural practice of hand weeding thrice resulted in highest rhizome yield (22.51t/ha) owing to 94.45% weed control efficiency but could not found as profitable as integrated weed management treatments due to higher expenditure incurred on engaging labours. These results are in conformity with the results of Sachdeva et al., (2015) [11], Barla et al. (2015) [1] and Bhartty et al. (2017) [2].

Table 1: Weed density (No./m²), weed dry matter (g/m²) at harvest, weed control efficiency and weed index as influenced by different weed control treatments (pooled over three years)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Weed density (No./m²) (Monocot + Dicot)</th>
<th>Weed dry matter (g/m²) (Monocot + Dicot)</th>
<th>WCE (%)</th>
<th>Weed Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1: Metribuzin 0.7 kg / ha (0-5 DAP) fb 2 hand weeding (45 &amp; 75 DAP)</td>
<td>6.71 (44.85)</td>
<td>7.69 (58.85)</td>
<td>7.22 (51.75)</td>
<td>7.21 (51.82)</td>
</tr>
<tr>
<td>T2: Metribuzin 0.7 kg / ha (0-5 DAP) fb fenoxaprop + metsulfuron (67+4 g / ha) Tank mix 45 DAP.</td>
<td>7.06 (49.46)</td>
<td>8.00 (63.46)</td>
<td>7.53 (56.18)</td>
<td>7.53 (56.37)</td>
</tr>
<tr>
<td>T3: Pendimethalin 1 kg / ha (0-5 DAP) fb 2 HW (45 &amp; 75 DAP)</td>
<td>6.28 (38.97)</td>
<td>7.31 (52.17)</td>
<td>6.90 (47.14)</td>
<td>6.83 (46.36)</td>
</tr>
<tr>
<td>T4: Pendimethalin 1 kg / ha (0-5 DAP) fb fenoxaprop + metsulfuron (67+4 g / ha) Tank mix 45 DAP.</td>
<td>7.18 (51.13)</td>
<td>8.10 (65.13)</td>
<td>7.61 (57.56)</td>
<td>7.63 (57.94)</td>
</tr>
<tr>
<td>T5: Pendimethalin 1 kg / ha (0-5 DAP) fb 10 t / ha (10 DAP) fb one HW (75 DAP).</td>
<td>6.23 (38.44)</td>
<td>7.27 (52.44)</td>
<td>6.74 (44.93)</td>
<td>6.75 (45.27)</td>
</tr>
<tr>
<td>T6: Atrazine 0.75 kg/ha (0-5 DAP) fb two HW (45 &amp; 75 DAP)</td>
<td>7.28 (52.48)</td>
<td>7.19 (52.58)</td>
<td>6.61 (45.09)</td>
<td>6.00 (50.05)</td>
</tr>
<tr>
<td>T7: Atrazine 0.75 kg/ha (0-5 DAP) fb fenoxaprop + metsulfuron (67+4 g / ha) Tank mix 45 DAP.</td>
<td>7.66 (58.16)</td>
<td>8.52 (72.16)</td>
<td>8.16 (66.14)</td>
<td>8.11 (65.49)</td>
</tr>
<tr>
<td>T8: Atrazine 0.75 kg/ha (0-5 DAP) fb fenoxaprop + metsulfuron (67+4 g / ha) Tank mix 45 DAP.</td>
<td>6.55 (42.35)</td>
<td>7.54 (56.35)</td>
<td>7.10 (50.18)</td>
<td>7.07 (49.63)</td>
</tr>
<tr>
<td>T9: Oxadiazyl 0.25 kg/ha (0-5 DAP) fb two HW (45 &amp; 75 DAP)</td>
<td>7.03 (48.99)</td>
<td>7.96 (62.99)</td>
<td>7.52 (56.22)</td>
<td>7.50 (56.07)</td>
</tr>
<tr>
<td>T10: Oxadiazyl 0.25 kg/ha (0-5 DAP) fb two HW (45 &amp; 75 DAP)</td>
<td>7.10 (50.01)</td>
<td>8.03 (64.01)</td>
<td>7.59 (57.24)</td>
<td>7.59 (57.09)</td>
</tr>
</tbody>
</table>

~ 761 ~
### Conclusion

It was concluded that application of pre emergence herbicides either with Pendimethalin 1 kg/ha or by Metribuzin 0.7 kg / ha or Atrazine 0.75 kg/ha (0-5 DAP) fb straw mulch 10 t / ha (10 DAP) fb one HW (75 DAP) found to be suitable and economical herbicidal weed management in turmeric.

### References