*J. Natn. Sci. Coun. Sri Lanka 1987* **15** (2) : *175–182*

# THRESHOLD WEED COMPETITION DURATION OF MUNGBEAN *(PHASEOLUS AUREUS. ROXB)*

N. SENANAYAKE AND R. P. S. P. PATHIRANA
*Regional Research Station, Angunukolapellessa, Sri Lanka.*

*(Date of receipt : 05 September 1985)*
*(Date of acceptance : 02 June 1987)*

**Abstract :** The threshold weed competition duration of mungbean with respect to the natural weed flora was investigated by allowing the weeds to compete with the crop for different durations ranging from 5 to 42 days after seeding (DAS) at the Agricultural Research Station, Angunukolapalessa, during Maha (wet) season 1984/85 and Yala (dry) season 1985. The data showed that the threshold weed competition duration of mungbean to be 35 DAS without any seasonal variation on threshold level. The gain on grain yield at threshold level was 101% and 102% during Maha 1984/85 and Yala 1985, respectively. The pod number was most affected by the weed competition.

## 1. Introduction

Weeds are nourished by the same nutrients and environmental factors needed by the crop. Because of the limited supply of these elements, weeds compete with the crop to procure them. Weed control attempts to shift competition in favour of the crop to make it more competitive than the weeds.

The duration of weed competition can be defined as the time where competition between weed and crop persist from the time of crop seed germination. Mercardo[7] indicated that weed competition duration critical to crops varies with the type of the crop, and observed it by either allowing the crop to compete with weeds or keep the crop weed-free for different durations. The author further indicated that all crops demand weed control during the early period of growth, particularly the first 1/3 to 1/2 of its life cycle. Klingman *et al.*[4] concluded that the weed competition early in the season is more critical in reducing crop yields than late season competition.

Legumes are very sensitive to weed competition and early season weed control is necessary to get optimum yields. Asian Vegetable Research and Development Centre (AVRDC)[1] reported 27% and Madrid and Manimtim[5] 10% yield loss of mungbean due to uncontrolled weed growth. Further, yield depression of 9% compared to weed free control was observed in 5 mungbean varieties when weeded 2 weeks after emergence.[8] Weed competition reduces branching[2] and pods per plant.[2,9] The present study was undertaken to find out the threshold weed competition duration of mungbean.

## 2. Materials and Methods

The experiments were conducted at the Regional Research Station, Angunukolapellessa during Maha 1984/85 (wet) season and Yala 1985 (dry) season using a randomized complete block design, replicated three times. The soils at the experimental site belonged to Ranna series of reddish brown earths in the well drained land class. During the experimental period, the crop received 212.7 mm and 129.6 mm rainfall and daily temperature ranged from 24.6°C – 25.9°C and 27.3°C – 28.2°C during Maha and Yala seasons, respectively.

Mung bean variety M.I. 4 with a growth duration of 65 days was used. Mungbean seeds were dibbled at 30 cm x 10 cm spacing in 4 m x 3 m plots and thinned out to one plant per hill. The crop was allowed to compete with weeds upto 6, 12, 16, 20, 25, 29, 35 and 42 days after seeding (DAS) during Maha and 5, 10, 15, 20, 25, 30, 35 and 40 DAS during Yala and were compared with a weeded and an unweeded control. N.P.K. at the rate of 15:60:47 kg/ha was applied basally with a top dressing of urea at the rate of 30 kg/ha at flowering stage. Pod borer damage was observed at flowering stage in both seasons, which was controlled by spraying Azodrin at the rate of 62 ml/ha.

Plant height and pod number per plant were recorded from 10 randomly selected plants at harvest. Number of seeds per pod from 25 randomly selected pods, 1000 seed weight and yield/ha were recorded. The individual plots are weeded at the end of weed competition duration and weighed. A representative sample of weeds was then weighed and dried in an oven to constant weight. The ratio of fresh weight to dry weight was thus obtained and the weed dry weight of plots were calculated by multiplying the weed fresh weight by this factor. Dry matter production of mungbean in a weeded and an unweeded plot was monitored at weekly intervals in two separate plots treated same way as for experiment. Plants were sampled and dried in an oven to constant weight to obtain the dry matter yield per plant.

## 3. Results and Discussion

The weed population during the Maha season mainly consisted of grasses and sedges. The presence of sedges was due to the cultivation of wetland rice in the area for several seasons, even though the soil were well drained. Among the grasses, *Echinocloa crusgalli* was dominant. During the Yala season, the experimental site was changed and the weed population was dominated by broad-leaved *Euphorbia geneculata L.* and grasses. Sedges were less and consisted mainly of *Cyperus rotundus*. Of the two seasons, the pod borer outbreak was severe during Yala and was observed at the late flowering stage.

Table 1. Dry matter yield of mungbean g/plant

| Age of plant in weeks | Dry matter yield g/plant | | | |
|---|---|---|---|---|
| | 1984/85 Maha | | 1985 Yala | |
| | Weeded | Unweeded | Weeded | Unweeded |
| 1 | 0.17 | 0.16 | 1.20 | 1.10 |
| 2 | 0.87 | 0.76 | 2.40 | 2.10 |
| 3 | 4.23 | 3.39 | 5.30 | 4.00 |
| 4 | 5.80 | 6.28 | 10.80 | 7.40 |
| 5 | 16.70 | 10.70 | 25.80 | 18.50 |
| 6 | 30.40 | 23.50 | 36.30 | 35.80 |
| 7 | 41.1* | 30.30* | 87.70 | 55.70 |
| 8 | 48.4* | 33.30* | 95.60 | 64.30 |

* – without pods

Mungbean dry matter production increased with the increase in age of the crop, irrespective of the weed competition (Table 1). However, the rate of increase was lower in the unweeded treatment. The maximum growth period extended upto 42 DAS in both seasons. The plant height was drastically reduced when the weed competition duration exceeded more than 35 DAS in Maha (Table 2) where as in Yala there was no such reduction (Table 3). The plant height in Maha season was low (49 – 60 cms) compared to the Yala season (59 – 69 cms). This could be attributed to the higher rainfall received during the Maha season (212.7 mm), compared to Yala season (127.6 mm). Madrid and Vega[6] also observed that mungbean can compete favourably with weeds during the dry season than during the wet season.

The yield components showed no significant difference except in pod number per plant during Maha season (Tables 2 and 3). However pods per plant and 1000 seed weight decreased, with the increase in weed competition duration in both seasons. However, the decrease in these parameters were not consistent and the difference between the weeded and unweeded control was very high. The number of pods per plant was significantly low, when the weed competition duration exceeds 29 DAS. Enyi, and Rethinum *et al.*[2,9] reported that the pod number per plant decrease with the increase in duration of weed competition. The other yield components were not affected by the weed competition except where the competition duration extended upto the harvest. The seed number per pod and pod number per plant were high in Maha season even though the plants were taller in Yala. This could probably be attributed to the severe pod borer damage during the Yala season destroying the early pods which are normally long and bear higher number of seeds per pod.

Table 2. Plant height and yield components of mung bean at harvest Maha 1984/85 season

| Treatment | Plant height cm | Pod No/Plant | Seed No/Pod | 100 Seed weight gm |
|---|---|---|---|---|
| Weed free 2 DAS | 54.6 | 16.8a | 12.2 | 47.1 |
| " 12 DAS | 56.8 | 16.5a | 11.1 | 47.8 |
| " 16DAS | 54.9 | 12.7a | 10.8 | 46.9 |
| " 20 DAS | 56.0 | 13.8a | 10.7 | 48.6 |
| " 27 DAS | 52.4 | 9.8a | 11.1 | 46.2 |
| " 29 DAS | 57.8 | 10.9a | 11.4 | 48.9 |
| " 35 DAS | 56.2 | 9.4b | 11.6 | 47.8 |
| " 42 DAS | 44.6 | 9.3b | 10.5 | 47.6 |
| Unweeded control | 50.1 | 8.5b | 9.5 | 44.9 |
| Weeded control | 60.7 N.S. | 13.7a | 10.9 N.S. | 50.5 N.S. |

Any two means followed by the same letter are not significantly different at 5% level.

Table 3. Plant height and yield components of Mungbean at harvest – Yala 1985

| Treatment | Plant height cm | Pod No/Plant | Seed No/Pod | 1000 Seed weight gm |
|---|---|---|---|---|
| 1. Weed free 5 DAS | 68.2 | 10.0 | 7.5 | 48.0 |
| 2. " 10 DAS | 69.1 | 10.6 | 8.7 | 49.3 |
| 3. " 15 DAS | 66.4 | 10.6 | 7.9 | 47.8 |
| 4. " 20 DAS | 63.7 | 10.3 | 7.7 | 48.4 |
| 5. " 25 DAS | 62.7 | 12.3 | 7.4 | 48.1 |
| 6. " 30 DAS | 64.9 | 10.1 | 8.6 | 48.6 |
| 7. " 35 DAS | 63.2 | 10.7 | 7.5 | 47.0 |
| 8. " 40 DAS | 62.2 | 8.5 | 8.4 | 45.7 |
| 9. Unweeded control | 59.5 | 9.4 | 8.2 | 43.2 |
| 10. Weeded control | 66.5 N.S. | 12.7 N.S. | 7.3 N.S. | 47.5 N.S. |

Mungbean grain yields obtained during the Maha was higher than the Yala season. The lower yields in the Yala season could be due to the severe pod borer attack observed at late flowering stage.

Table 4. Grain yield and percentage increase in yield

| TREATMENT | 1984/85 Maha | | 1985 Yala | |
|---|---|---|---|---|
| | Yield/ha | % increase over unweeded control | Yield/ha | % increase over unweeded control |
| Weed free 5 DAS | – | – | 566.3 a | 109.9 |
| " 6 DAS | 976.6 a | 208.5 | – | – |
| " 10 DAS | – | – | 597.4 a | 126.5 |
| " 12 DAS | 961.1 a | 203.6 | – | – |
| " 15 DAS | – | – | 502.3 a | 86.2 |
| " 16 DAS | 894.0 a | 182.4 | – | – |
| " 20 DAS | 911.3 a | 187.8 | 592.3 a | 119.6 |
| " 25 DAS | – | – | 434.3 b | 61.0 |
| " 27 DAS | 597.2 a | 88.6 | – | – |
| " 29 DAS | 647.3 a | 104.5 | – | – |
| " 30 DAS | – | – | 490.4 a | 81.8 |
| " 35 DAS | 635.3 a | 100.6 | 545.9 a | 102.4 |
| " 40 DAS | – | – | 367.2 c | 36.1 |
| " 42 DAS | 440.0 b | 39.0 | – | – |
| Unweeded control | 316.6 b | – | 269.7 d | – |
| Weeded control | 917.9 a | 189.9 | 518.5 a | 92.2 |
| C. V. = 22.7% | | | 20.2% | |

Any two means followed by the same letter are not significantly different at 5% level.

Significant decrease in grain yield in both seasons was observed when the weed competition duration exceeded 35 DAS. Similar results were observed by Madrid and Vega[6] in mungbean yields if crop-weed competition was more than 4 weeks during the wet and dry seasons under irrigation in Philippines. They also reported that weeds had little effect if they were allowed to compete with mungbean for 2 weeks during the wet season and 4 weeks during the dry season. Present study showed no seasonal variability in threshold weed competition duration. Nevertheless, grain yield decreased significantly in treatment 25 DAS (Table 4) during Yala which could be attributed to exceptionally high weed density observed in these plots (Table 5).

Table 5. Weed dry weight under different treatments

| Treatment | Weed dry weight g/plot | |
|---|---|---|
| | Maha 1984/85 | Yala 1985 |
| Weed free 5 DAS | – | 17.5 |
| " 6 DAS | 68.3 a | – |
| " 10 DAS | – | 50.7 |
| " 12DAS | 240.8 a | – |
| " 15 DAS | – | 70.8 |
| " 16 DAS | 417.2 a | – |
| " 20 DAS | 822.3 a | 359.0 |
| " 25 DAS | – | 1518.0 |
| " 27 DAS | 1114.8 b | – |
| " 29 DAS | 1126.2 b | – |
| " 30 DAS | – | 792.0 |
| " 35 DAS | 1460.3 c | 748.0 |
| " 40 DAS | – | 1413.0 |
| " 42 DAS | 2803.4 d | – |
| Unweeded control | – | – |
| Weeded control | – | – |

Any two means followed by the same letter are not significantly different at 5% level.

The increase in grain yield over unweeded control was subjected to seasonal variability with a higher increase in the Maha season. However, early weeding resulted in a greater increase in grain yield. One late weeding 35 DAS resulted in 100.6% and 102.4% yield increase over unweeded control during Maha and Yala seasons respectively. The seasonal difference in grain yield could be attributed to the differences in competing weed species and their densities. Higher weed density dominated by monocots during the Maha was more competitive and their removal at different competition durations resulted in higher grain yields, unlike the Yala season where the weed population dominated by broad leaved weeds. However, if the weed competition continued upto harvest time broad leaved weeds are equally competitive as monocots at high density (comparable yields of two unweeded controls, Table 4). Moody[8] also reported that one late weeding 30 DAS, an average yield increase of 34% over the unweeded control could be obtained.

Grain yield data also indicate that yield performance of mungbean during the Maha season was better that the Yala season under irrigation. This however, is doubtful due to pod borer damage in the Yala season.

## Conclusion

The results indicate that the threshold weed competition duration of Mungbean was 35 DAS and the yield component most affected by the weed competition was pod number per plant. Further, a late weeding 35 DAS leads to 100.6% and 102.4% increase in yield over the unweeded control during Maha and Yala seasons respectively. The seasonal difference in grain yield could be attributed to the differences in competing weed species and their densities during the two seasons. However, there is no seasonal variation in threshold weed competition duration.

### References

1. ASIAN VEGETABLE RESEARCH AND DEVELOPMENT CENTRE (AVRDC) (1976) *Mungbean report for 1975,* Asian Veg. Res. Cent., Shanhua, Taiwan.

2. ENYI, B.A.C. (1973) An analysis of the effect of weed competition on growth and yield attributes in Sorghum *(Sorghum vulgare)* Cowpea *(Vigna unguiculata)* and green gram *(Vigna aueus) J. Agric. Sci.* **81**: 449–453.

3. HERRERS, W. T., ZANDSTRA, H. G. & LIBOON, S. P. (1977) *The Management of Mungbean in rice based cropping system* p. 115 – 119 in R. Cowell (ed.) 1st. Int. Mungbean Symp. Asian Vag. Res. Develo. Cent. Shanjua, Taiwan.

4. KLINGMAN, G. C., ASHTAN, F. M. & NOORDHOFF, L. J. (1975) *Weed Science Principles and Practices* John Wiley & Sons, New York, pp. 431.

5. MADRID, M. J. Jr. & MANIMTIM, M. B. (1977) – *Weed control in Mungbean in weed Science Report 1976 – 1977* Dept. Agron. Univ. Philipp. Los Banos, College, Laguna, Phillippines.

6. MADRID, M. J. Jr. & VEGA, M. R. (1977) – Duration of weed control and weed competition and the effect on yield. 1. Mungbean *(Phaseolus aureus.* L.) *Philip. Agric.* 55 : 216 – 220.

7. MERCARDO, B.L. (1979) – *Introduction to Weed Science,* Southeast Asian Regional Centre for graduate study and Research in Agriculture, College, Laguna, Philippines pp. 292.

8. MOODY, K. (1977) — *Weed control in Mungbean* p. 132 – 136 In. R. Cowell (ed.) 1st. Int. Mungbean Symp. Asian Vig. Res. Devel. Cent. Shanhua, Taiwan.

9. RETHINAM, P. SANKARAN, N., SANKARAN, S. & MORACHAN, Y. B. (1976) — Studies on crop weed competition in green gram under irrigated conditions. *Madras Agric. J.* 63 : 464 – 466.

10. VATS, O. P. & SIDHU, M. S. (1977) *Critical period of crop weed competition in Mungbean* p. 45. In Weed Sci. Conf. and Workshop in India. January 1977 (Abstr.), 17–20.