Esxon Publishers

International Journal of Applied Research and Technology
ISSN 2277-0585

Publication details, including instructions for authors and subscription information:
http://www.esxpublishers.com

Effect of Row Spacing and Weeding Regime on Weed Management in Soybean (*Glycine max* (L.) Merrill).

Mamudu, A.Y., Aderemi, K. L. and Oyewale, R. O.

Federal University of Technology, Minna, Niger State, Nigeria.

Available online: June 30, 2022.

To cite this article:

Mamudu, A.Y., Aderemi, K. L. and Oyewale, R. O. (2022). Effect of Row Spacing and Weeding Regime on Weed Management in Soybean (Glycine max (L.) Merrill). *International Journal of Applied Research and Technology. 11(06)*: 21 – 29.

PLEASE SCROLL DOWN FOR ARTICLE

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan, sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contexts will be complete or accurate or up to date. The accuracy of any instruction, formulae and analysis should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Esxon Publishers

International Journal of Applied Research and Technology
Vol. 11, No. 06, June *2022, 21 – 29.*

Effect of Row Spacing and Weeding Regime on Weed Management in Soybean (*Glycine max* (L.) Merrill).

Mamudu, A.Y., Aderemi, K. L. and Oyewale, R. O.

Federal University of Technology, Minna, Niger State, Nigeria.

(Received: 14 June 2022 / Accepted: 16 June 2022 / Published: 30 June 2022).

Abstract

Weed interference is a major factor attributed to the poor yields of soybean in Nigeria, critical period of crop-weed competition and weed threshold are two important aspects in a weed management program in any crop. This experiment was conducted to study the influence of row spacing on the competitiveness of soybeans with weeds and the effect of different periods of weed interference on weed infestation growth and yield of soybean. There are twelve treatments consisting of weed-infested and weed-free with plant density at intra-row spacing of 25 cm and 30 cm and inter-row spacing of 75 cm. The treatments were laid out in a Randomized Complete Block Design (RCBD) and replicated three times. Plots where weeds were controlled for 4, 6 weeks and until harvest at 25cm spacing indicate 70–75% significant reduction in weed density and dry matter, resulting in increase in soybean grain yield compared to plot where delay in weed removal until 6 weeks or longer depressed soybean growth and resulted in irrevocable yield reduction, with the number of pods per plant being the most affected yield component. For optimum growth and yield, it was only necessary to keep the crop weed-free between 4 and 6 weeks.

Key words: Row spacing, weed competition, critical period, soybean yield.

For corresponding author:
E-mail: *info@esxpublishers.com*
Subject: *0622-0211.*
© 2022* Esxon Publishers*. All rights reserved

Introduction

Soybean (*Glycine max* L.) is an important economic legume crop, largely cultivated by smallholder farmers in Sub-Saharan Africa (SSA) (Joubert and Jooste, 2013). It is one of the most popular crops cultivated by smallholder farmers in sub-Sahara Africa (SSA) because of its multiple uses, such asa cheap source of protein and oil for human diet, feed for livestock and aquaculture, and biofuel for industry (Joubert and Jooste 2013). Soybean fixes atmospheric nitrogen, which makes it an important crop for improving soil fertility for smallholder farmers, who are often unable to afford synthetic nitrogen fertilizers (Sanginga *et al*., 2003). Nigeria currently produces only 25% (680,000 tons) of its annual soybean requirement (2.2 million tons) with an average yield of 960 kg ha leaving a supply gap of 1.5 million tones (Khojely *et al.,* 2018). Among different factors attributed to the poor yield and productivity of soybean in Nigeria and other parts of SSA, weed infestation appears to be the most deleterious (Imoloame, 2014; Daramola *et al*., 2020). weed infestation has caused an average yield reduction of 37%, whereas other pests and diseases account for 22% yield reduction (Oerke and Dehne, 2004). In Nigeria, between 77% and 90% reduction in potential soybean yield attributable to weed infestation was reported from different zones (Imoloame, 2014). Weed control in soybean in the humid tropics is however always a challenge as soybean is a weak competitor against fast-growing weeds, and infestation of soybean field by weeds, such as *Imperata cylindrica, Rottboellia cochinchinensis, Cynodon dactylon, Tridax procumbens, Euphorbia heterophylla,* and many others could lead to total yield loss if not properly controlled (Imoloame 2014; Daramola *et al*. 2018). In addition, the planting time of soybean (June/July) often coincides with other field operations and peak rainfall. During this period, labor is limited, and the environment is more conducive for excessive weed infestation, resulting in higher cost of weed control and greater yield reduction. Weeding with hand hoes is the predominant management technique used by farmers in Nigeria. However, this method is tedious, inefficient and extremely expensive (Adigun and Lagoke 2003; Imoloame 2014). Besides the high cost, availability of labor for weeding is uncertain, especially during critical periods of weed control, resulting in delayed weeding, or weeding after the crops have suffered irreversible damage from weeds (Adigun 2005; Chikoye *et al*. 2007). Uncontrolled weeds could reduce yield of soybean by up to 5% depending on the density and variety (Nathanael *et al*., 2013). Contrary views exist as to the right time for effective weed control. Hand weeding is the predominant weed control practice on smallholder farms (Vissoh *et al*., 2004). Keeping the crop free of weeds for the first third of its life cycle usually assures near maximum productivity (Doll, 2003). According to Orr *et al*. (2002) two properly spaced hand weeding within eight weeks of planting of maize (at three weeks and six weeks) give yields comparable to keeping the crop weed-free for the first eight weeks after planting. Consequently, farmers usually weed their farms at different times and different intervals narrow-row soybeans competed successfully with weeds that emerged three weeks after planting, whereas wider-row soybeans needed four weeks to become competitive. The shading provided by narrow-row soybeans was as effective as a lay by cultivation in controlling late-emerging weeds. When grown under optimal conditions, narrow-row soybeans generally result in higher than wide rows. Narrow-row planting alters the competitive relationship between crop and weeds by influencing the rate at which the soybean canopy covers the soil surface. The increased competitiveness of narrow-row soybeans can improve the efficiency of weed management programs. The most effective weed management programs in soybeans uses a combination of cultural, mechanical, and chemical control strategies (Grichar *et al*., 2004). Cultural practices include such factors as planting date, planting rate, and row spacing (Holshouser *et al*., 2002). The main objective of this study was to evaluate the effectiveness of row spacing and weeding regime on weed control, growth and yield of soybean.

Materials and Methods

The field experiment was conducted at the Teaching and Research Farm of Federal University of Technology, Minna (latitude $9^0 37^1$ N and longitude $6^0 33^1$ E) located in the Southern Guinea Savanna Ecological Zone of Nigeria. The climate of Minna is sub-humid tropical, characterized with a long term mean rainfall of about 1284mm and a mono-modal pattern of rainfall. The rainy season begins in April and ends early October with peaks in September. The area has a distinct dry season of about 5 months duration occurring from November to March. The mean maximum temperature remains high throughout the year at about 32ºc (ranges from 35ºc to 37 ºc particularly during March and through June, while the relative humidity span between 40% and 80%. The soils of Minna are generally Alfisols. The treatments were laid out in a Randomized Complete Block Design (RCBD) and replicated three times. There were twelve treatments consisting of weed-infested for 2, 4, 6, and 8 weeks after when the plot was weed-free to harvest then the control was weed-free from sowing to harvest with plant density at intra-row spacing of 25 cm and 30 cm. Seeds were directly sown at two seeds per hole at 25cm by 75cm, and 30cm by 75cm intra and inter-row spacing respectively. Seedlings were thinned down to two plant per stands per stand at 4 weeks after sowing. Manual weeding was carried out according to design treatments of the experiment. Data were collected on Weed cover score, Weed dry Weight, Plant height, Stand count, Pod Weight, Number of pods per plant and Grain yield. Data collected were subjected to analysis of variance (ANOVA) using Statistical Analysis System (SAS) procedure, version 9, 2002 model to test significance of treatments effects. The means were compared using Duncan's Multiple Range Test at 5 % probability level.

Result and Discussions

Effect of row spacing and weeding regime on weed cover score and weed dry weight

The Data presented in Table 1 are the weed cover score and weed dry weight as influence by row spacing and weeding regime. Soybean +Spacing 25cm + weed-infested for 2 weeks, Soybean + Spacing 25cm + weed- free plot from 0 to the end, Soybean +spacing 30cm + weed-infested for 2 weeks and Soybean + spacing 30cm + weed- free plot from 0 to the end significantly ($P< 0.05$) gave the lowest weed cover score (1.00, 1.00, 1.00 and 1.00) compared to other treatments at 4 week, same trend was seen at 6 and 8 WAS except in treatment with Soybean +Spacing 25cm + weed-infested for 2 weeks which also recorded higher cover score (Table 1). Soybean + Spacing 25cm + weed- free plot from 0 to the end and Soybean + spacing 30cm + weed -free plot from 0 to the end significantly (P<0.05) recorded lowest weed dry weight throughout the sampling period (4, 6 and 8 WAS), (9.00kg, 7.20kg, and 5.20kg respectively) and (10.10kg, 10.96kg and 6.00kg respectively) compared to the highest seen in Soybean +Spacing 30cm + weed-infested till harvest (34.10kg, 54.96kg and 50.20kg) and other treatments (Table 1).

Effect of row spacing and weeding regime on plant stand count and plant height

Plant stand count were not significantly different, but Soybean + spacing 30cm + weed- free plot to the end seemingly influenced stand count as highest stand count was observed (Table 2). Plant height was significant (P<0.05) at 6 week after sowing, treatment with Soybean + Spacing 25cm + weed- free plot to the end gave the highest plant height (18.97cm) as compared to the lowest seen in treatment with soybean +Spacing 30cm + weed-infested till harvest (13.40cm). (Table 2). Other observation periods (4 and 8 WAS) were not significant

Effect of row spacing and weeding regime on pod weight and number of pods per plot

Table 3 showed that. Soybean + Spacing 25cm + weed-free plot to the end gave the highest significantly (p<0.05) pod weight (85.94kg) compared to other treatments. Number of pods per plot showed same trend with the pod weight, soybean + Spacing 25cm + weed- free plot to the end were significantly (p<0.05) recorded highest number of pods (186.87kg) compared to the lowest seen in treatment with Soybean +Spacing 30cm + weed-infested till harvest (113.33)

Effect of row spacing and weeding regime on Grain yield

Treatment with soybean + Spacing 25cm + weed- free plot to the end significantly (P<0.05) gave the highest grain yield (11.90kg) compared to the lowest seen in treatment with Soybean +Spacing 30cm + weed-infested till harvest (9.50kg) and Soybean +Spacing 25cm + weedy till harvest (9.76kg) (Table 4)

Discussion

The lower weed cover score observed in treatment with soybean + Spacing 25cm + weed- free plot to the end shows that reduction in weed growth with narrow-row spacing was probably attributed to rapid canopy closure that limits light penetration to the weed emerging below the crop. This was in agreement with the work of Chauchan *et a.l* (2016) and Adigun *et al*., (2017) who reported that rapid canopy cover, reduces weed competitiveness with reduction in row spacing.
The lower dry weight recorded in the same treatments as weed cover score shows that canopy closure which restrict weed growth and hence the fewer weed recorded on these treatments translated into lower weed dry weight. This is in agreement with the work of Imolaome (2014) who reported that row spacing in soybean can suppress late emergence of weed.

The higher plant height recorded in the same treatments as in previous parameters at 6 WAS could be as a result of few weed recorded in the treatment which result in good plant growth hence the higher plant height. This is in agreement with the work of Dhane *et al.* (2010) who reported that the inability of weed to compete for growth factors with the crop could possibly result in better accumulations of photosynthates. The higher pod weight recorded in treatment with 25cm row spacing and weed free plot could be as a result of lower weed present which gave the plant good establishment and hence the higher pod weight recorded. This is in agreement to the work of Chauchan and Johnson (2010) who reported that narrow-row spacing reduces weed germination and growth.

The higher number of pods and higher pod weight per plot recorded in treatment with soybean + Spacing 25cm + weed- free plot to the end could be as a result of lower weed present in the plot and which gave the plant good establishment and hence the higher number of pods per plot. This is in agreement with the work of Chauchan and Johnson (2010) who reported that narrow-row spacing reduces weed germination and growth. The higher grain yield recorded in the treatments mention above could be as a result of good performance in lower weed cover score, higher plant height, higher pod weight and higher number of pods per plot which translated into good yield. This is in agreement to the work of Bullock *et al.* (2007) who reported that reduced row spacing within the plant and between rows increases the plant total biomass

Conclusion and Recommendation

It could be concluded that Narrow-row planting as seen in 25cm spacing alters the competitive relationship between crop and weeds by influencing the rate at which the soybean canopy covers the soil surface than 30cm spacing as seen in the parameters. Weed infestation for within 2 to 3 weeks after sowing had no detrimental effect on soybean growth and yield probably because weeds were not yet well established and hence reduced competitiveness at this time. Treatment with soybean+25cm narrow-row spacing and weed-infested for 2 weeks and weed- free plot throughout the period of crop growth gives best performance on growth and yield of soybean. The increased competitiveness of narrow-row soybeans can improve the efficiency of weed management programs. The treatment could therefore be concluded to be an effective weed management strategy on weed control in soybean.

References

Adigun, J. A. and Lagoke, S. T. O. (2003). Weed Control in Transplanted Rain and Irrigated Tomatoes in the Nigerian Savanna. *Nigerian Journal of Weed Science*, 16: 23–29.

Adigun, J. A. 2005. "Critical Period of Weed Interference in Rainfed and Irrigated Tomatoes in the Nigerian Savanna." *Agricultura Tropica Et Subtropica* 38 (2): 73–79.

Adigun, J. A., S. O. Daramola, O. R. Adeyemi, P. M. Olorunmaiye, O. A. Osipitan, and O. Idiodemise. 2017. "Effects of Row Spacing and Period of Weed Interference on Growth and Yield of Cowpea (vigna Unguiculata (L.) Walp)." *Nigerian Journal of Ecology 16 (2): 88–100.*

Bullock DG, Nielsen RL, Nyquist WE (1988). A growth analysis comparison of corn grown in conventional and equidistant plant spacing. Crop Sci. 28: 254- 258

Chauchan, B. S., and D. E. Johnson. 2010. "Implications of Narrow Crop Row Spacing and Delayed Echinochloa Colona and Echinochloa Crusgalli Emergence for Weed Growth and Crop Yield Loss in Aerobic Rice." Field Crops Research 117: 177–182. doi: 10.1016/j.fcr.2010.02.014

Chauhan, B. S., K. F. Singarayer, J. F. Connor, and G. C. Rodolfo. 2016. "Implications of Narrow Crop Row Spacing in Managing Weeds in Mungbean (vigna Radiata)." Crop Protection 30: 1–4.

Chikoye, D., J. Ellis-Jones, C. Riches, and L. Kanyomeka. 2007. "Weed Management in Africa: Experiences, Challenges and Opportunities." XVI International Plant Protection Congress 468: 652–653.

Daramola, O. S., O. R. Adeyemi, J. A. Adigun, and C. O. Adejuyigbe. 2018. "Crop-weed Association and Inter-relationships in Soybean-weed Ecosystem in the Nigerian Savannah Transition Zone." *Nigerian Journal of Ecology* 17 (2): 97–114.

Daramola, O.S., Adeyemi, O.R., Adigun, J.A., & Adejuyigbe, C.O. (2020). Weed interference and control as affected by row spacing in the transition zone of south west Nigeria. *Journal of Crop Improvement*, *34* (1), 103-121.

Grichar, W.J., Bessler, B.A., Brewer, K.D. (2004). Effect of row spacing and herbicide dose on weed control and grain sorghum yield. Crop Prot. 23:263–267.

Holshouser, D.L., Whittaker, J.P. (2002). Plant population and row-spacing effects on early soybean production systems in the mid-Atlantic USA. Agron. J. 94:603–611

Imoloame, E. O. 2014. "The Effects of Different Weed Control Methods on Weed Infestation, Growth and Yield of Soybeans (glycine Max (L) Merrill) in the Southern Guinea Savanna of Nigeria." Agro Search 14 (2): 129–143.

Joubert, J. C. N., and A. A. Jooste. 2013. "Comparative Analysis of Different Regions of South Africa Soybean Industry." Proceedings of the World Soybean Research Conference IX, Urban, South Africa, February 18–22.

Khojely, D. M., S. E. Ibrahim, E. Sepey, and T. Han. 2018. "History, Current Status, and Prospect of Soybean Production and Research in sub-Saharan Africa." *The Crop Journal* 6: 226–235. doi:10.1016/j.cj.2018.03.006.

Nathanael, D.F., Chris, M.B., David, E.S. (2013). Soybean Yield Loss Potential Associated with Early-Season Weed Competition across 64 Site-Years. Weed Science: July-September 2013, Vol. 61, No. 3, pp.500-507. http://dx.doi.org/10.1614/WS-D-12-00164.1

Oerke, E. C., and H. W. Dehne. 2004. "Safeguarding Production-losses in Major Crops and the Role of Crop Protection." Crop Production 23: 275–285.

Sanginga, N., K. Dashiell, and J. Diels. 2003. "Sustainable Resource Management Coupled to Resilient Germplasm to Provide New Intensive Cereal–Grain Legume–Livestock Systems in the Dry Savanna." Agriculture, Ecosystems and Environment 100: 305–525. doi:10.1016/ S0167-8809(03)00188-9.

Vissoh, P. V. Gbèhounou, G. Ahanchédé, A. Kuyper T.W. & Röling, N.G. 2004. Weeds as agricultural constraint to farmers in Benin: results of a diagnostic study. NJAS - Wageningen *Journal of Life Sciences* 52: 305-329.

Table

Table 1: Effect of row spacing and weeding regime on weed cover score and weed dry weight

	Weed Cover Score			Weed Dry Weight (kg)		
Treatment	4 WAS	6 WAS	8WAS	4 WAS	6 WAS	8 WAS
$T_1= SS_1W_0$	2.00[a]	5.00[a]	6.00[a]	32.59[a]	30.52[c]	25.70[bc]
$T_2= SS_1W_2$	1.00[b]	4.33[bc]	5.00[b]	31.30[a]	20.04[ef]	14.60[e]
$T_3= SS_1W_4$	2.00[a]	1.00[d]	4.00[c]	22.52[abc]	27.68[cd]	27.30[d]
$T_4=SS_1W_6$	2.00[a]	4.00[c]	1.00[d]	25.96[ab]	14.10[fg]	21.20[de]
$T_5= SS_1W_8$	2.00[a]	4.33[bc]	6.00[a]	12.74[bc]	32.33[c]	28.90[cd]
$T_6= SS_1W_{0-8}$	1.00[b]	1.00[d]	1.00[d]	9.00[c]	7.20[g]	5.20[f]
$T_7= SS_2W_0$	2.00[a]	5.00[a]	6.00[a]	34.10[a]	54.96[a]	50.20[a]
$T_8= SS_2W_2$	1.00[b]	4.67[ab]	5.00[b]	32.59[a]	23.10[de]	21.70[de]
$T_9= SS_2W_4$	2.00[a]	1.00[d]	4.00[c]	33.80[a]	21.15[de]	27.20[d]
$T_{10}= SS_2W_6$	2.00[a]	4.00[c]	1.00[d]	22.40[abc]	26.00[cde]	36.24[bc]
$T_{11}= SS_2W_8$	2.00[a]	4.67[ab]	6.00[a]	16.27[bc]	45.13[b]	42.30[b]
$T_{12}= SS_2W_{0-8}$	1.00[b]	1.00[d]	1.00[d]	10.10[c]	10.96[g]	6.00[f]
SE±	0.08	0.29	0.36	1.89	2.30	2.30

Means with the same letter (s) in a column are not significantly different according to Duncan Multiple Range Test (DMRT) at 5 % level of probability.

WAS: Weeks after sowing

T_1= (SS_1W_0) = soybean +Spacing 25cm + weed-infested till harvest
T_2= (SS_1W_2) = soybean +Spacing 25cm + weed-infested for 2 weeks
T_3= (SS_1W_4) = soybean + Spacing 25cm + weed-infested for 4 weeks
T_4= (SS_1W_6) = soybean +spacing 25cm + weed-infested for 6 weeks
T_5= (SS_1W_8) = soybean +Spacing 25cm + weed-infested for 8 weeks
T_6= (SS_1WF_{0-END}) = soybean + Spacing 25cm + weed- free plot to the end
T_7= (SS_2W_0) = soybean +Spacing 30cm + weed-infested till harvest
T_8= (SS_2W_2) = soybean +spacing 30cm + weed-infested for 2 weeks
T_9= (SS_2W_4) = soybean + spacing 30cm + weed-infested for 4 weeks
T_{10}= (SS_2W_6) = soybean + Spacing 30cm + weed-infested for 6 weeks
T_{11}= (SS_2W_8) = Soybean + Spacing 30cm + weed-infested for 8 weeks
T_{12}= (SS_2WF_{0-END}) = Soybean + spacing 30cm + weed- free plot to the end

Table 2: Effect of row spacing and weeding regime on plant stand count and plant height

Treatment	Plant Stand Count	Plant Height (cm) 4 WAS	6 WAS	8WAS
$T_1= SS_1W_0$	35.00[a]	8.33[a]	15.17[ab]	21.03[a]
$T_2= SS_1W_2$	36.00[a]	10.00[a]	15.80[ab]	23.83[a]
$T_3= SS_1W_4$	36.33[a]	9.10[a]	15.27[ab]	21.90[a]
$T_4=SS_1W6$	36.00[a]	9.10[a]	14.57[ab]	19.87[a]
$T_5= SS_1W_8$	35.00[a]	9.50[a]	14.33[ab]	20.23[a]
$T_6= SS_1W_{0-8}$	37.00[a]	9.00[a]	18.97[a]	25.27[a]
$T_7= SS_2W_0$	35.00[a]	9.00[a]	13.40[b]	21.37[a]
$T_8= SS_2W_2$	37.00[a]	9.13[a]	16.10[ab]	23.93[a]
$T_9= SS_2W_4$	36.33[a]	9.00[a]	14.50[ab]	21.47[a]
$T_{10}= SS_2W_6$	35.00[a]	9.33[a]	15.33[ab]	18.03[a]
$T_{11}= SS_2W_8$	35.00[a]	9.00[a]	14.33[ab]	21.30[a]
$T_{12}= SS_2W_{0-8}$	38.00[a]	9.30[a]	17.00[ab]	26.53[a]
SE±	0.17	0.46	0.74	

Means with the same letter (s) in a column are not significantly different according to Duncan Multiple Range Test (DMRT) at 5 % level of probability.

WAS: Weeks after sowing

T_1= (SS_1W_0) = soybean +Spacing 25cm + weed-infested till harvest
T_2= (SS_1W_2) = soybean +Spacing 25cm + weed-infested for 2 weeks
T_3= (SS_1W_4) = soybean + Spacing 25cm + weed-infested for 4 weeks
T_4= (SS_1W_6) = soybean +spacing 25cm + weed-infested for 6 weeks
T_5= (SS_1W_8) = soybean +Spacing 25cm + weed-infested for 8 weeks
T_6= (SS_1WF_{0-END}) = soybean + Spacing 25cm + weed- free plot to the end
T_7= (SS_2W_0) = soybean +Spacing 30cm + weed-infested till harvest
T_8= (SS_2W_2) = soybean +spacing 30cm + weed-infested for 2 weeks
T_9= (SS_2W_4) = soybean + spacing 30cm + weed-infested for 4 weeks
T_{10}= (SS_2W_6) = soybean + Spacing 30cm + weed-infested for 6 weeks
T_{11}= (SS_2W_8) = Soybean + Spacing 30cm + weed-infested for 8 weeks
T_{12}= (SS_2WF_{0-END}) = Soybean + spacing 30cm + weed- free plot to the end

Table 3: Effect of row spacing and weeding regime on pod weight (kg) and number of pods per plot

Treatment	Pod Weight (kg)	Number of pods per plot
$T_1= SS_1W_0$	33.40^{b}	122.00^{bc}
$T_2= SS_1W_2$	31.27^{b}	167.67^{abc}
$T_3= SS_1W_4$	63.03^{ab}	134.67^{abc}
$T_4=SS_1W_6$	53.77^{ab}	175.67^{abc}
$T_5= SS_1W_8$	35.07^{b}	126.67^{abc}
$T_6= SS_1W_{0-8}$	85.94^{a}	186.67^{a}
$T_7= SS_2W_0$	25.00^{b}	113.33^{c}
$T_8= SS_2W_2$	28.60^{b}	163.00^{abc}
$T_9= SS_2W_4$	34.90^{b}	181.67^{ab}
$T_{10}= SS_2W_6$	30.07^{b}	136.00^{abc}
$T_{11}= SS_2W_8$	43.23^{ab}	119.67^{bc}
$T_{12}= SS_2W_{0-8}$	60.17^{ab}	181.67^{ab}
SE±	4.63	6.40

Means with the same letter (s) in a column are not significantly different according to Duncan Multiple Range Test (DMRT) at 5 % level of probability.

WAS: Weeks after sowing

T_1= (SS_1W_0) = soybean +Spacing 25cm + weedy till harvest
T_2= (SS_1W_2) = soybean +Spacing 25cm + weedy for 2 weeks
T_3= (SS_1W_4) = soybean + Spacing 25cm + weedy for 4 weeks
T_4= (SS_1W_6) = soybean +spacing 25cm + weedy for 6 weeks
T_5= (SS_1W_8) = soybean +Spacing 25cm + weedy for 8 weeks
T_6= ($SS_1WF_{0\text{-}END}$) = soybean + Spacing 25cm + weed free plot to the end
T_7= (SS_2W_0) = soybean +Spacing 30cm + weed-infested till harvest
T_8= (SS_2W_2) = soybean +spacing 30cm + weedy for 2 weeks
T_9= (SS_2W_4) = soybean + spacing 30cm + weedy for 4 weeks
T_{10}= (SS_2W_6) = soybean + Spacing 30cm + weedy for 6 weeks
T_{11}= (SS_2W_8) = Soybean + Spacing 30cm + weedy for 8 weeks
T_{12}= ($SS_2WF_{0\text{-}END}$) = Soybean + spacing 30cm + weed free plot to the end

Table 4: Effect of row spacing and weeding regime on Grain yield

Treatment	**Grain yield (kg/plot)**
$T_1 = SS_1W_0$	9.76[f]
$T_2 = SS_1W_2$	11.33[abc]
$T_3 = SS_1W_4$	10.62[abcd]
$T_4 = SS_1W_6$	10.40[def]
$T_5 = SS_1W_8$	10.20[cdef]
$T_6 = SS_1W_{0-8}$	11.90[a]
$T_7 = SS_2W_0$	9.50[f]
$T_8 = SS_2W_2$	11.12[abc]
$T_9 = SS_2W_4$	10.50[bcde]
$T_{10} = SS_2W_6$	10.64[def]
$T_{11} = SS_2W_8$	10.21[ef]
$T_{12} = SS_2W_{0-8}$	11.82[ab]
SE±	0.11

Means with the same letter (s) in a column are not significantly different according to Duncan Multiple Range Test (DMRT) at 5 % level of probability.

WAS: Weeks after sowing

$T_1 = (SS_1W_0)$ = soybean +Spacing 25cm + weedy till harvest
$T_2 = (SS_1W_2)$ = soybean +Spacing 25cm + weedy for 2 weeks
$T_3 = (SS_1W_4)$ = soybean + Spacing 25cm + weedy for 4 weeks
$T_4 = (SS_1W_6)$ = soybean +spacing 25cm + weedy for 6 weeks
$T_5 = (SS_1W_8)$ = soybean +Spacing 25cm + weedy for 8 weeks
$T_6 = (SS_1WF_{0-END})$ = soybean + Spacing 25cm + weed free plot to the end
$T_7 = (SS_2W_0)$ = soybean +Spacing 30cm + weed-infested till harvest
$T_8 = (SS_2W_2)$ = soybean +spacing 30cm + weedy for 2 weeks
$T_9 = (SS_2W_4)$ = soybean + spacing 30cm + weedy for 4 weeks
$T_{10} = (SS_2W_6)$ = soybean + Spacing 30cm + weedy for 6 weeks
$T_{11} = (SS_2W_8)$ = Soybean + Spacing 30cm + weedy for 8 weeks
$T_{12} = (SS_2WF_{0-END})$ = Soybean + spacing 30cm