Reprint ISSN 1991-3036 (Web Version)

International Journal of Sustainable Crop Production (IJSCP)

(*Int. J. Sustain. Crop Prod.*)

Volume: 19	Issue: 1	February 2024

Int. J. Sustain. Crop Prod. 19(1): 16-20 (February 2024)

EFFECT OF INTEGRATED WEED MANAGEMENT ON THE GROWTH PERFORMANCE OF WHEAT

D. HALDER, M.L. MIA, M.F. ISLAM, M.S. ZAHEDI, M.A.R. SIUM, R. AHAMMED, M.S.A. JOLY, M.S. ISLAM AND M. BEGUM

An International Scientific Research Publisher

Green Global Foundation©

Web address: http://ggfjournals.com/e-journals archive

E-mails: editor@ggfjournals.com and editor.int.correspondence@ggfjournals.com

ISSN-1991-3036 (Online)
Int. J. Sustain. Crop Prod. 19(1):16-20(February 2024)

EFFECT OF INTEGRATED WEED MANAGEMENT ON THE GROWTH PERFORMANCE OF WHEAT

D. HALDER[1,2], M.L. MIA[2], M.F. ISLAM[2], M.S. ZAHEDI[3], M.A.R. SIUM[4], R. AHAMMED[2], M.S.A. JOLY[5], M.S. ISLAM[2]* AND M. BEGUM[2]

[1]Scientific Officer, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh; [2]Department of Agronomy, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; [3]Faculty of Agricultural Engineering and Technology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; [4]Department of Agricultural Extension Education, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; [5]Faculty of Agricultural Economics and Rural Sociology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

Accepted for publication on 15 January 2024

ABSTRACT

Halder D, Mia ML, Islam MF, Zahedi MS, Sium MAR, Ahammed R, Joly MSA, Islam MS, Begum M (2024) Effect of integrated weed management on the growth performance of wheat. *Int. J. Sustain. Crop Prod.* 19(1), 16-20.

Our experiment was carried out at the Agronomy Field Laboratory, Department of Agronomy, Bangladesh Agricultural University (BAU), Mymensingh during the period from November 2019 to March 2020. The objectives of this study were to determine the influence and comparative efficiency of different weed management practices under integrated weed management of wheat. The experiment comprised three replication groups which composed of fourteen weeding regime treatments, namely, unweeded, Mulching by rice straw, Mulching by water hyacinth, Two-hand weedings at 25 and 35 DAS, Pre-emergence herbicide, Pre-emergence herbicide + hand weeding at 35 DAS, Pre-emergence herbicide + mulching by water hyacinth, Post-emergence herbicide, Stale seed bed + post-emergence herbicide, Post-emergence herbicide + hand weeding at 35 DAS, Post-emergence herbicide + mulching by rice straw, Post-emergence herbicide + mulching by water hyacinth, Pre-emergence herbicide + Post-emergence herbicide, Pre-emergence herbicide + Post-emergence herbicide + hand weeding at 35 DAS. The experiment was laid out in a randomized complete block design. Data on different parameters were recorded. Five dominant weed species were identified in the Agronomy Field Laboratory at BAU namely Biskatali, Bothua, Panida, Mutha and Anguli. This result indicates that the application of post-emergence herbicide + mulching by rice straw could be used as the best-integrated weed control practice in wheat. But for confirmation, more studies are needed to be conducted at different AEZs of Bangladesh.

Key words: *integrated weed management, weed performance, weed control, crop management, weed density, herbicide resistance*

INTRODUCTION

One of the most significant grain crops is wheat (*Triticum* spp.), which is produced on roughly 225 million ha of land worldwide and produces 734045 thousand tons per year (FAO 2018). Roughly half of this land is in developing nations. Wheat was the primary commodity with a total global import and export of 181,127,600 tons and 190,853,600 tons, respectively. In Bangladesh, there are 3.73 million hectares of total wheat cultivation, producing 1099 thousand tons of wheat annually in 2018 (FAO 2018). Due to competition from other food grain crops, the cultivation of wheat and mustard has been transferred to marginal croplands with low yields. Consumption is rising steadily because of the expanding population. Therefore, it is generally acknowledged that a significant increase in output is required to meet the demand (Halim *et al.* 2023). Though wheat is an important cereal crop in Bangladesh, the average yield of wheat is lower than that of other wheat-growing countries around the world. The total cultivable land has been decreasing day by day due to increasing population. Urbanization, industrialization and construction of various institutions are increasing rapidly due to overpopulation. That's why agricultural land for crop production was reduced. Many of the scientists reported weed as the major constraint to wheat cultivation (Priya *et al.* 2017).

Weed, sometimes known as a silent killer of crops, is one of the most significant factors that reduce yields globally (Priya *et al.* 2017). In addition to lowering crop output and quality, weeds also take up valuable space, soil moisture, and light (Ramalingam *et al.* 2013). Additionally, weeds raised the price of harvesting and production. Different weed management techniques, including manual, cultural, chemical, mechanical, and biological ones, can be used to eradicate weeds (Dhananivetha *et al.* 2017). Weed species now present, crop type, crop growth stage, weed species, labor cost, and availability are only a few of the variables that affect weed control strategies (Bell and Boutwell, 2001). It could not be cost-effective to eradicate weeds all year long (Khan *et al.* 2021). According to Dhananivetha *et al.* (2017) and Sanker *et al.* (2015), the traditional approach of weed eradication using only a hand or hoe is incredibly time-consuming, expensive, less effective, and has to be performed frequently. Herbicides must be used in this situation to effectively and promptly control weeds. Thus, it is crucial to plan a proper strategy for weed management through the application of several herbicides (Sanker *et al.* 2015). However, frequent and improper use of herbicides not only pollutes the environment but also has a negative impact on the sustainability of agricultural production (Gyani *et al.* 2020). Additionally, using weedicides alone is ineffective for providing effective control. In integrated weed management, the use of cultural, manual, mechanical, and/or chemical control methods is a possibility. To attain the best productivity of high-quality production, you need a good integrated weed management strategy.

*Corresponding author & address: Md. Shafiqul Islam; E-mail: shafiqagron@bau.edu.bd
Dipok Halder, Md. Liton Mia, Md. Fakhrul Islam, Md. Shabab Zahedi, Md. Abdur Rahim Sium, Rayhan Ahammed, Mst. Sayma Akter Joly, Md. Shafiqul Islam, Mahfuza Begum

As a more contemporary concept, integrated weed management integrates two or more weed control techniques to provide outcomes that are superior to those attained when only one technique is applied (Das 2019). Given the characteristics of weed communities, no single weed management strategy has demonstrated to be the "magic bullet" for removing weed issues. The optimum strategy might be to combine a cropping system plan, knowledge of ecological processes, and all available weed control methods into a thorough weed management system. For weed science researchers and growers, integrating ecological principles into decision-making regarding weed management is a significant problem. Although it does not completely eradicate them, an integrated weed management plan reduces the impact of weeds (Hussain *et al.* 2021).

MATERIALS AND METHODS

Experimental site and design

Geographically, the experimental site is located at 24°75'N latitude and 90°50'E longitude at an elevation of 18m above sea level. The site falls under the Old Brahmaputra Floodplain Agro-ecological Zone- AEZ-9 (UNDP and FAO, 1988). The experiment was laid out in a randomized complete block design with three replications. Total number of unit plots in the experiment were 14 x 3 = 42. The unit plot size was 4.0 m x 2.5 m. The plot-to-plot distance was 0.5 m and from block-to-block distance was 1.0 m having a provision for an irrigation channel. High-yielding wheat variety BARI Gham-28 was used as the plant material in the experiment. BARI Gham-28 is a short-duration, heat-tolerant cultivar of wheat developed and released by the Bangladesh Agricultural Research Institute (BARI).

Soil and climate

The experimental field was a medium-high land with silty clay loam soil texture having pH value of 6.7. The experimental site belongs to Non-calcareous Dark-grey Floodplain Soil. The experimental area is situated under a subtropical climate, characterized by high temperature, high humidity and heavy rainfall with occasional gusty winds during April-September (Kharif season) and scanty rainfall associated with moderately low temperature but plenty of sunshine from October to March (Rabi season). The atmospheric temperature tends to increase from February, as the season proceeds towards Kharif. During the wheat farming season, which runs from November to April in Mymensingh, Bangladesh, the weather usually changes from the conclusion of the monsoon season to drier, cooler conditions. Reduced rainfall during this time of year is usual, especially in January and February, which makes the early phases of wheat development and sowing advantageous. Rainfall in March and April, however, can help later growth stages like flowering and grain filling.

Plant material

High-yielding wheat variety BARI Gom-28 was used as the plant material in the experiment. BARI Gom-28 is a short-duration, heat-tolerant cultivar of wheat developed and released by the Wheat Research Centre of Bangladesh Agricultural Research Institute (BARI), Dinajpur 5200. The variety can be cultivated in any part of Bangladesh and is suitable for optimum and late planting conditions. This variety attains a height of 95-100 cm and takes 102-108 days to complete life-cycle and is resistant to leaf rust and tolerant to Bipolaris leaf blight disease.

Experimental treatment

There were 14 treatments in this experiment. These are as follows: Unweeded (T_0), Mulching by rice straw at 6 t ha^{-1} (T_1), Mulching by water hyacinth at 6 t ha^{-1} (T_2), Two hand weeding at 25 and 35 DAS (T_3), Pre-emergence herbicide (Panida) (T_4), Pre-emergence herbicide + hand weeding at 35 DAS (T_5), Pre-emergence herbicide + mulching by rice straw at 6 t ha^{-1} (T_6), Pre-emergence herbicide + mulching by water hyacinth at 6 t ha^{-1} (T_7), Post-emergence herbicide (Affinity) (T_8), Post-emergence herbicide + hand weeding at 35 DAS (T_9), Post-emergence herbicide + mulching by rice straw (T_{10}), Post-emergence herbicide + mulching by water hyacinth (T_{11}), Pre-emergence herbicide + Post-emergence herbicide (T_{12}), Pre-emergence herbicide + Post-emergence herbicide + hand weeding at 35 DAS (T_{13}).

Land preparation

The experimental land was opened with a tractor-drawn disc plough 15 days before sowing. The land was further ploughed and cross-ploughed four times with a country plough followed by laddering for breaking clods and leveling the land. The corners and levels of the land were trimmed by spade and visible larger clods were broken into small pieces by wooden hammer. All weeds and stubbles were removed from the land. The whole experimental land was divided into unit plots maintaining the desired spacing.

Fertilizer application

The plots were fertilized with triple super phosphate (TSP), muriate of potash (MoP), gypsum, zinc (Zn) and boron (B) at the following recommended doses: TSP= 150 kg ha^{-1}, MoP= 75 kg ha^{-1}, Gypsum= 100 kg ha^{-1}, Zn= 2.5 kg ha^{-1}, B= 1.25 kg ha^{-1}. The whole amount of TSP, MoP and gypsum and one-third of urea were applied just before final land preparation. The rest amount of urea was applied in two equal splits at 20 and 40 DAS.

Seed sowing

Wheat seeds were collected from the Bangladesh Agriculture Development Corporation (BADC) marketing office in Khagdohor, Mymensingh. Seeds were sown in line on 28 November 2019 as per treatment specifications. Sowing depth was maintained at 5 cm, and seeds were covered with soil immediately after sowing. Care was taken to protect the seeds and seedlings from birds up to 20 DAS.

Intercultural operations

Various intercultural operations were done to ensure and maintain the normal 15 growth of the crop.

Weeding

The weeding operation was done as per experimental treatments. In case of no weeding control treatment weeds were allowed to grow in the plots throughout the growing season but for weed-free treatment weeds were not allowed to grow in the plots at all and they were removed by hand when they were found.

Irrigation and drainage

The crop was irrigated once at the crown root initiation stage at 20 DAS following flood irrigation.

Pest management

As there was no remarkable infestation of disease and insects, no plant protection measure was taken.

Weed parameters

Weed density

Data on the density of weeds were collected from each plot of wheat field by using 0.25 m^{-2} quadrate as per the method described by Cruz *et al.* (1986). The quadrate was placed at random in each plot and kept for taking data on weed density. In each plot, all weeds inside the quadrate were counted species-wise and their average values were converted to number m^{-2}.

Weed dry weight (g m^{-2})

After counting the weeds in each quadrate, the weeds were uprooted plot-wise. Weeds were washed and dried at first in the sun and thereafter, in an electrical oven for 72 hours maintaining a constant temperature of 65^0C. After drying, the weight of the weeds of each plot was taken by an electrical balance. The average oven-dry weight of weeds was expressed in g m^{-2}.

Statistical analysis

Data on, yield and yield parameters were compiled, tabulated and analyzed statistically using the analysis of variance technique. Analysis of variance was done and the mean differences were adjudged by Duncan's Multiple Range Test (DMRT) according to Gomez and Gomez (1984) with the help of a computer package program (M-STAT).

RESULTS AND DISCUSSION

Infested Weed Species in the Experimental Field

Twenty weed species belonging to seven families infested the experimental field. Among eleven weed species, most of them were grasses and sedges. The local name scientific name, family, and growing season of weed of the experimental plot have been presented in Table 1.

Table 1. Infesting weed species found in the experimental plots in maize

Sl. No.	Local name	English name	Scientific name	Family	Growing season
01	Anguli ghas	Crab grass	*Digitaria sangunalis* (L.) Scop.	Poaceae	Kharif
02	Bathua	Lambsquarter	*Chenopodium album* L.	Chenopodiaceae	Rabi
03	Biskatali	Smart weed	*Polygonum hydropiper* L.	Polygonaceae	Rabi-Kharif
04	Bon sharisha	Wild mustard	*Brassica kaber* (DC.) L.C. Wheeler	Cruciferae	Rabi
05	Banmasur	Fineleaf fumitory	*Fumaria parviflora* Lamk.	Fumariaceae	Rabi
06	Chela ghash	Sheand grass	*Parapholis incurua* (L.) C.E.Hubb.	Poaceae	Kharif
07	Chanchi	Joyweed	*Alternanthera sessilis* R. Br.	Amaranthaceae	Rabi-Kharif
08	Durba	Bermuda grass	*Cynodon dactylon* (L.) Pers.	Poaceae	Rabi-Kharif
09	Foska begun	Clammy ground cherry	*Physalis minima* L.	Solanaceae	Rabi
10	Halud nakphul	Toothache Plant	*Spilanthes acmella* L.	Compositae	Rabi-Kharif
11	Bon palong	Bitter dock	*Rumex maritimus* L.	Polygonaceae	Rabi-Kharif
12	Keshuti	False daisy	*Eclipta alba* Hassk.	Compositae	Rabi-Kharif
13	Bontula	Corn thistle	*Sonchus arvensis* L.	Asteraceae	Rabi
14	Khet papri	Lindernia	*Lindernia procumbens*	Scrophulariaceae	Rabi
15	Pani marich	Prince's feather	*Polygonum orientale* L.	Polygonaceae	Kharif
16	Mutha	Purple nut sedge	*Cyperus rotundus* L.	Cyperaceae	Rabi-Kharif
17	Mashurchana	Common vetch	*Vicia hirsuta* (L.) S.F. Gray	Leguminosae	Rabi
18	Shama	Barnyard grass	*Echinochloa crusgalli* (L.) Beauv.	Poaceae	Rabi-Kharif
19	Tita begun	Tita begun	*Slonum torvum*	Solanaceae	Kharif
20	Panida/Footki	Asian watergrass	*Hygrorhyza aristata* (Retz.) Nees ex Wight & Arn.	Poaceae	Rabi-Kharif

Effect of Weed Density and Dry Weight

Weed density

The highest weed density (358.68 no. m^{-2}) was found in treatment T_3 (Two hand weeding at 25 and 35 DAS). The lowest weed density (141.61 no. m^{-2}) was found in T_6 (Pre-emergence herbicide + mulching by rice straw at 6 t ha^{-1}) treatment. The other treatments produced intermediate results (Figure 1). Similar research findings were observed by Samtani *et al.* (2007) where the author reported that weed density was lower in the case of integrated weed control practices compared to the un-weeded control plot.

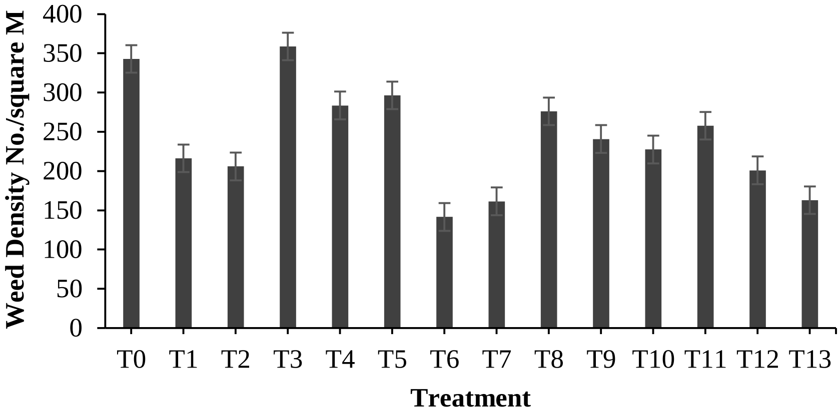

Fig. 1. Effect of treatment on weed density

Unweeded (T_0); Mulching by rice straw at 6 t ha^{-1} (T_1); Mulching by water hyacinth 6 t ha^{-1} (T_2); Two hand weeding at 25 and 35 DAS (T_3); Pre-emergence herbicide (Panida 33 EC) (T_4); Pre-emergence herbicide (Panida 33 EC) + hand weeding at 35 DAS (T_5); Pre-emergence herbicide (Panida 33 EC) + mulching by rice straw at 6 t ha^{-1} (T_6); Pre-emergence herbicide (Panida 33 EC) + mulching by water hyacinth at 6 t ha^{-1} (T_7); Post-emergence herbicide (Affinity 50.75 WP) (T_8); Post-emergence herbicide + hand weeding at 35 DAS (T_9); Post-emergence herbicide (Affinity 50.75 WP) + mulching by rice straw (T_{10}); Post-emergence herbicide (Affinity 50.75 WP) + mulching by water hyacinth (T_{11}); Pre-emergence herbicide (Panida 33 EC) + Post-emergence herbicide (Affinity 50.75 WP) (T_{12}); Pre-emergence herbicide (Panida 33 EC) + Post-emergence herbicide (Affinity 50.75 WP) + hand weeding at 35 DAS (T_{13}).

Dry weight

The highest weed dry weight (89.31 gm^{-2}) was found in treatment T_1 (unweeded and no mulch) followed by T_0 (Unweeded). The lowest weed density (15.81 gm^{-2}) was found in T_{13} (Pre-emergence herbicide + post-emergence herbicide + hand weeding at 35 DAS) treatment. The other treatments produced the intermediate results (Figure 2). Mehmood *et al.* (2018) also reported that the maximum weed dry weight was recorded in un-weeded control which was significantly higher compared to weed control practices with integration of mulches.

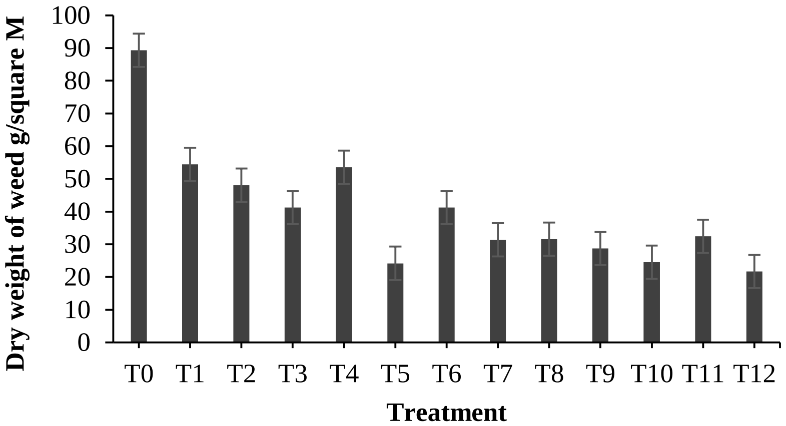

Fig. 2. Effect of treatment on dry weight

Unweeded (T_0); Mulching by rice straw at 6 t ha^{-1} (T_1); Mulching by water hyacinth 6 t ha^{-1} (T_2); Two hand weeding at 25 and 35 DAS (T_3); Pre-emergence herbicide (Panida 33 EC) (T_4); Pre-emergence herbicide (Panida 33 EC) + hand weeding at 35 DAS (T_5); Pre-emergence herbicide (Panida 33 EC) + mulching by rice straw at 6 t ha^{-1} (T_6); Pre-emergence herbicide (Panida 33 EC) + mulching by water hyacinth at 6 t ha^{-1} (T_7); Post-emergence herbicide (Affinity 50.75 WP) (T_8); Post-emergence herbicide + hand weeding at 35 DAS (T_9); Post-emergence herbicide (Affinity 50.75 WP) + mulching by rice straw (T_{10}); Post-emergence herbicide (Affinity 50.75 WP) + mulching by water hyacinth (T_{11}); Pre-emergence herbicide (Panida 33 EC) + Post-emergence herbicide (Affinity 50.75 WP) (T_{12}); Pre-emergence herbicide (Panida 33 EC) + Post-emergence herbicide (Affinity 50.75 WP) + hand weeding at 35 DAS (T_{13}).

SUMMARY AND CONCLUSION

The application of weed management has a considerable impact on every aspect of the crop attributes. Wheat benefited from a treatment of T10 post-emergence herbicide combined with rice straw mulching. Based on the current study, it can be said that the best-integrated weed control method for wheat is the application of post-emergence herbicide combined with mulching by rice straw. More research must be done, nevertheless, in various Bangladeshi AEZs, to conform.

REFERENCES

Bell C, Boutwell B (2001) Combining bensulide and pendimethalin controls weeds in onions. *California Agriculture*, 55(1), 35-38.

Cruz I, Waquil JM, Santos JP, Viana PA, Salgado LO (1986) Pragas da cultura do milho em condições de campo: métodos de controle e manuseio de defensivos. Sete Lagoas: Embrapa-CNPMS, p 35 (Circular Técnica, 10).

Das TK (2019) Weed Science: Basics and Application. Jain Brothers Publication, New Delhi, India, p.908.

Dhananivetha M, Amnullah MM, Arthanari PM, Mariappan S (2017) Weed management in onion: A review. *Agricultural Review* 38(1), 76-80.

FAO (2018) The State of Food and Agriculture 2019. Moving forward on food loss and waste reduction. Rome (also available at http://www.fao.org/3/ca6030en/ca6030en.pdf).

Gomez KA, Gomez AA (1984) Statistical procedures for agricultural research. John Wiley & Sons. pp. 97-129, 207-215.

Gyani LG, Khan N, Ansari MH, Siddqui MZ, Naz H, Moied A, Kumar A (2020) Planting pattern and weed management practices on the productivity of onion (*Allium cepa* L.). *Journal of Pharmacognosy and Phytochemistry*, 9(5), 2140-2144.

Halim A, Paul SK, Sarkar MAR, Rashid MH, Perveen S, Mia ML, Islam MS, Islam AKMM (2023) Field Assessment of Two Micronutrients (Zinc and Boron) on the Seed Yield and Oil Content of Mustard. Seeds, 2, 127-137.

Hussain MI, Abideen Z, Danish S, Asghar MA, Iqbal K (2021) Integrated weed management for sustainable agriculture. *Sustainable Agriculture Reviews* 52, 367-393. DOI: https://doi.org/10.1007/978-3-030-73245-5_11

Khan MA, Rahman MM, Mou SS (2021) Effect of integrated weed management practices on the growth, yield, quality and economic of onion (*Allium cepa* L.*). Archives of Agriculture and Environmental Science,* 6(3), 277-289.

Mehmood T, Khan SU, Qayyum A, Gurmani AR, Ahmed W, Liaquat M, Farid A (2018) Evaluation of organic and inorganic mulching as an integrated weed management strategy in maize under rainfed conditions. *Planta Daninha*, 36(2). https://doi.org/10.1590/S0100-83582018360100143

Priya RS, Chinnusamy C, Arthanari PM, Hariharasudhan V (2017) A review on weed management in onion under Indian tropical conditions. *Chemical Science Review and Letter*, 6(22), 923-932.

Ramalingam SP, Chinnappagounder C, Perumal M, Palanisamy MA (2013) Evaluation of new formulation of oxyfluorfen (23.5% EC) for weed control efficacy and bulb yield in onion. *American Journal of Plant Science*, 4, 890-895. DOI:10.4236/ajps.2013.44109

Samtani JB, Kling GJ, Mathers HM, Case L (2007) Rice hulls, leaf-waste pellets, and pine bark as herbicide carriers for container-grown woody ornamentals. *Horticulture Technology*, 17(3), 289–295. DOI: https://doi.org/10.21273/HORTTECH.17.3.289

Sanker V, Thangasami A, Lawande KE (2015) Weed management studies in onion (*Allium cepa* L.) cv. N-2-4-1 during rabi season. *International Journal of Tropical Agriculture*, 33(2), 627-631.

UNDP, FAO (1988) Land Resources Appraisal of Bangladesh for Agricultural Development. Report 2. Agro-ecological Regions of Bangladesh. Bangladesh Agricultural research council, Dhaka-1207. pp. 212-221.