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RESEARCH

EFFECT OF PRE AND POST-EMERGENCE HERBICIDES ON *CYPERUS ROTUNDUS*INFESTATION IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

Rahul Dhankar[1], Sushil Kumar Singh[1], Sharad Kumar Singh[2,], Todarmal[1], Preeti Dhanker, M.D. Parihar[1] and Pradeep Kumar[1]

[1]Department of Agronomy, CCSHAU, Hisar
[2]Banda University of Agriculture and Technology, Banda
Email: sksiddhu.rajput@gmail.com

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Abstract: Groundnut, also known as peanut, is a leguminous plant belonging to the Fabaceae family. It is widely cultivated for its edible seeds, which are commonly consumed as snacks or used in cooking and food preparation around the world. The *Cyperus rotundus*, commonly known as purple nut sedge, is a challenging weed in many crops, including groundnut (*Arachis hypogaea* L.). It can significantly reduce crop yields due to its aggressive growth and ability to compete for resources. The use of pre- and post-emergence herbicides is a common strategy to manage this weed. Here's an overview of how these herbicides affect *Cyperus rotundus* infestation in groundnut. Thecrop is highly susceptible to weed infestation because of its slow growth in the initial stages up to 45 DAS, short plant height, and underground pod-bearing habit. In contrast to other crops, weeds not only compete for vital resources during different stages of crop growth but also hinder pegging, pod development, and harvesting of groundnut. The present study entitled "Effect of pre and post-emergence herbicides on *Cyperus rotundus*infestation in groundnut (*Arachis hypoaaea* L.)" was conducted at Agronomy Research Farm, CCS Haryana Agricultural University,Hisar during *Kharif* 2020.The experiment comprising sixteen treatments was laid out in randomized block design with three replications. Treatments consisted of weed management *viz*., were imazethapyr + pendimethalin (RM) at 1000 g/ha, 1250 g/ha, 1500 g/ha and 1000 g/ha with one hoeing at 30 DAS, pendimethalin at 1000 g/ha and 1000 g/ha with one hoeing at 30 DAS, imazethapyr at 70g/ha and 70g/ha with one hoeing at 30 DAS, imazethapyr + imazamox (RM) at 70g/ha, imazethapyr + imazamox (RM) at 70g/ha pre-emergence with one hoeing at 30 DAS as pre-emergence application and imazethapyr + quizalofop 70+50 g/ha, imazethapyr + imazamox (RM) + quizalofop 70+50, Acifluorfen+clodinafop (RM) at 305g/ha as post-emergence and two hoeing compared with weed free and weedy checks**.** The results indicatedthat at 30 DAS, pre – emergence application of imazethapyr + imazamox @ 1000 g ha^{-1}*fb* one hoeing at 30 DAS (T_{10}) recorded significantly minimum density (1.33 m^{-2}) of *Cyperus rotundus* as compared to other treatments and it was statistically at par with treatment T_4, with application of imazethapyr + pendimethalin (RM) @ 1000 g ha^{-1}*fb* one hoeing at 30 DAS (1.67 m^{-2}). At 60 DAS lower density of *Cyperus rotundus* was found from treatment T_{14} (two hoeing at 25 and 45 DAS) and it was statistically at par with pre-emergence application of imazethapyr + pendimethalin (RM) @1000 g ha^{-1}*fb* one hoeing (T_4). At 90 DAS, treatment T_4 in which imazethapyr + pendimethalin (RM) was applied as pre emergence @ 1000 g ha^{-1}*fb* one hoeing recorded significantly the minimum population of *Cyperus rotundus* in comparison to other treatments. In this way different treatment presented variable results in the experiment as discussed further.

Keywords: Groundnut, Herbicides, *Cyperus rotundus*, Pod yield

INTRODUCTION

India is the largest producer of oilseeds in the world. The country produces groundnut, soybean, sunflower, sesamum, niger seed, mustard and safflower oil seeds and oilseed sector occupies an important position in the country's economy. Groundnut or peanut (*Arachis hypogaea* L.) is also known as the 'king' of all oil seeds, is one of the supreme food as well as cash crop of our country. Groundnut is well accepted under the name wonder nut and poor men's cashew nut. The nut plays a vital role as resource in the dietary requirement of poor women and children. It is also known as peanut, earthnut, monkey nut or goobers. The crop is well grown in both tropical, sub-tropical regions and in the continental part of temperate countries. India stands first in terms of area and second in production rate after China. In India, the total area under groundnut crop is of 4.91 m ha with a total production of 9.18 m tonne and productivity of 1868 kg ha^{-1}(Anonymous, 2018). The major groundnut growing states of India are Gujarat (42.88%), Rajasthan (13.72%), Andhra Pradesh (11.43%), Tamil Nadu (10.61%), and Karnataka (6.08%). In terms of area, more than 80% of groundnut crop is grown in the kharif season. It is a rich source of protein (26%) and being an oil seed crop, it

*Corresponding Author

constitutes of 40 to 49 % of oil (Saturated 7%, Mono unsaturated 24% and Polyunsaturated 16%), so it is one of the most important crops for producing edible oil.

Groundnut, also known as peanut, is a leguminous plant belonging to the Fabaceae family. It is widely cultivated for its edible seeds, which are commonly consumed as snacks or used in cooking and food preparation around the world. The crop is highly susceptible to weed infestation because of its slow growth in the initial stages up to 45 DAS, short plant height, and underground pod-bearing habit. *Arachis hypogaea* L., sometimes referred to as the "king" of all oil seeds, is a commercial crop and one of the most important foods in our nation. Our country's principal food is groundnut, which is also a substantial cash crop. Peanut (*Arachis hypogaea* L.) is an important crop worldwide that contributes to local economies and food security (Fletcher and Shi, 2016) and (Valentine *et al*., 2016). Groundnut, sometimes known as the "wonder nut" and the "poor men's cashew nut," is essential for meeting the dietary needs of under privileged women and children (Naim *et al*., 2011). The critical period of crop weed competition is the main determinant of groundnut growth and production. During the first 45 days of the growth cycle, weeds significantly impair the groundnut crop. Crop-weed competition is estimated to be most intense between the dates of the critical period. According to Singh *et al*. (2014), the crucial time for crop-weed competition is between two and six weeks following seeding. The type of weed species associated with the crop, their densities, and the length of the crop's fight with the weeds all affect how much harm results from crop-weed competition. The presence of weed species is also greatly influenced by the type of crop and soil characteristics. In addition to serving as the primary host for many pest insects, weeds also serve as a major the presence of weed species is also greatly influenced by the type of crop and soil characteristics. The most common hosts for many insect pests are weeds, which also serve as the carriers of several serious diseases that affect groundnuts. Additionally, weeds release several allele compounds that have an impact on groundnuts. Therefore, it can be said that the primary crucial production component in groundnut agriculture is weed control. Due to its initial slow growth, groundnut is particularly vulnerable to weed infestation, which is one of the major factors contributing to decreased groundnut output. In the Haryana state groundnut-growing zones, the *Cyperus rotundus* is one of the most significant weed floras linked with the crop (Punia *et al*., 2016). The *Cyperus rotundus* weed competes for vital resources while also interfering with groundnut pegging, pod development, and harvesting at various phases of crop growth. One of the main causes of decreased crop output is weed infestation. Hand weeding and chemical weed management were used to minimize weed density and enhance pod yield in groundnut fields during the kharif season (*Sharma et al*., 2015). When grown in intercropping or rotation, groundnuts increase soil fertility by fixing nitrogen, which boosts the productivity of other crops (Ajeigbe *et al*., 2015). The research study aimed to assess the effectiveness of different herbicide treatments, both before and after the emergence of in controlling its infestation in groundnut (peanut) fields under irrigated conditions. *Cyperus rotundus* is a persistent and troublesome weed in agricultural settings, especially in crops like groundnut that require careful weed management to optimize yield. Pre-emergence herbicides are applied before the weeds germinate, targeting seeds and young plants, while post-emergence herbicides are applied after the weeds have emerged from the soil.

The efficacy of these herbicide treatments would likely be evaluated based on factors such as weed density (number of weeds per square meter), weed biomass, groundnut yield, and possibly other agronomic parameters like weed control efficiency and cost-effectiveness of the treatments. Research into effective herbicide strategies is crucial for farmers to minimize weed competition, which can significantly impact crop yields and quality.

MATERIALS AND METHODS

A research study titled "Effect of pre and post-emergence herbicides on *Cyperus rotundus* infestation in groundnut (*Arachis hypogaea* L.)" was carried out at the Research Farm of Agronomy, CCS Haryana Agriculture University, Hisar, during the Kharif season of 2020. The sowing of the groundnut crop (GNH 804 Variety) took place on June 24, 2020, under irrigated conditions with spacing of 30 × 15 cm. The experiment followed a randomized block design with three replications, consisting of sixteen treatments for weed management. The treatments included various herbicide combinations and hoeing practices. The herbicides used were imazethapyr + pendimethalin (RM) at different rates of 1000 g/ha, 1250 g/ha, 1500 g/ha, and 1000 g/ha with one hoeing at 30 days after sowing (DAS), pendimethalin at 1000 g/ha and 1000 g/ha with one hoeing at 30 DAS, imazethapyr at 70g/ha and 70g/ha with one hoeing at 30 DAS, imazethapyr + imazamox (RM) at70g/ hapre-emergence with one hoeing at 30 DAS, and imazethapyr + quizalofop 70+50 g/ha, imazethapyr + imazamox (RM) + quizalofop 70+50 post-emergence. Two hoeing treatments were also included, and these were compared with weed-free and weedy checks. The application of post-emergence herbicides occurred at 25 DAS, targeting the 2-3 leaf stages of weeds, using a knapsack sprayer equipped with a flat fan nozzle at a rate of 375 liters/ha. The groundnut crop was harvested in the last week of October, and all cultivation practices followed the prescribed package of practices of CCS

HAU, Hisar. To assess the density of *Cyperus rotundus*, observations were made at 30, 60, and 90 DAS using a 0.5 x 0.5 m^{-2} quadrants, and the recorded values were converted to per m^{-2}. This research study aimed to evaluate the efficacy of various pre and post-emergence herbicide treatments in managing *Cyperus rotundus*infestation in groundnut cultivation under irrigated conditions.

RESULTS AND DISCUSSION

(i) Density of *Cyperus rotundus*(no. m^{-2})

The data presented in Table 1 reveled that at 30 DAS, pre-emergence application of imazethapyr + imazamox @ 1000 g ha^{-1} *fb* one hoeing at 30 DAS (T_{10}) recorded significantly minimum density (1.33 m^{-2}) of *Cyperus rotundus* as compared to other treatments and it was statistically at par with treatment T_4, with application of imazethapyr + pendimethalin (RM) @ 1000 g ha^{-1} *fb* one hoeing at 30 DAS (1.67 m^{-2}). At 60 DAS, significantly lower density (16.33 m^{-2}) of *Cyperus rotundus* was reported from treatment T_{14} (two hoeing at 25 and 45 DAS) and it was statistically at par with pre-emergence application of imazethapyr + pendimethalin (RM) @1000 g ha^{-1} *fb* one hoeing (22.67 m^{-2}) (T_4), pendimethalin (PRE) *fb* one hoeing @ 1000 g ha^{-1} (23.00 m^{-2}) (T_6), imazethapyr (PRE) *fb* one hoeing (24.33 m^{-2}) (T_9) and imazethapyr + imazamox (RM) @1000 g ha^{-1} *fb* one hoeing(T_{10}) as pre -emergence (23 m^{-2}). At 90 DAS, treatment T_4 in which imazethapyr + pendimethalin (RM) was applied as pre emergence @ 1000 g ha^{-1} *fb* one hoeing recorded significantly the minimum population of Cyperous rotundus (30.33 m^{-2}) in comparison to other treatments. It was statistically at par with imazethapyr @1000 g ha^{-1} *fb* one hoeing (31.33 m^{-2}), imazethapyr + imazamox (RM) @1000 g ha^{-1} *fb* one hoeing (32.33 m^{-2}) and imazethapyr + pendimethalin (RM) @ 1000 g ha^{-1} (36 m^{-2}). The minimum and the maximum density of *Cyperus rotundus* was reported from weed free and weedy check, respectively at all the growth stages of the crop. The results reported in this study demonstrate a strong alignment with findings reported by contributors.

Table 1. Effect of different herbicide treatments on density (no.m^{-2}) of *Cyperus rotundus* at different Crop growth stages

Sr. No.	Herbicides	Dose(g/ha)	Timeof application	Weeddensityof*Cyperus rotundus*(no./m^{-2})		
				30DAS	60DAS	90DAS
1	Imazethapyr+pendimethalin(RM)	1000	PRE	6.39(40)	7.30(52.67)	6.78(45)
2	Imazethapyr+pendimethalin(RM)	1250	PRE	5.97(34.67)	7.09(49.67)	6.08(36)
3	Imazethapyr+pendimethalin(RM)	1500	PRE	6.09(36.33)	6.33(39.67)	6.43(40.33)
4	Imazethapyr+pendimethalin(RM)*fb* onehoeing	1000	PRE,30DAS	1.63(1.67)	4.79(22.67)	5.52(30.33)
5	Pendimethalin	1000	PRE	6.08(36)	7.09(49.33)	6.43(40.33)
6	Pendimethalin*fb* onehoeing	1000	PRE,30DAS	1.63(1.67)	4.85(23)	5.74(32)
7	Imazethapyr	70	PRE	4.89(23)	6.39(40.67)	6.76(44.67)
8	Imazethapyr+imazamox(RM)	70	PRE	4.44(19.33)	7.38(56.33)	6.73(44.33)
9	Imazethapyr*fb*onehoeing	70	PRE	1.63(1.67)	4.92(24.33)	5.60(31.33)
10	Imazethapyr+imazamox(RM)*fb*one hoeing	70	PRE,30DAS	1.52(1.33)	4.81(23)	5.77(32.33)
11	Imazethapyr+quizalofop	70+50	POST	7.31(52.67)	6.29(42)	7.94(62)
12	Imazethapyr+imazamox(RM)+quizalofop	70+50	POST	7.51(56.67)	6.97(49.33)	7.62(57)
13	Acifluorfen+clodinafop	305	POST	7.23(52.33)	7.16(51.00)	7.98(62.67)
14	Twohoeing	----	25& 45DAS	1.93(3)	4.11(16.33)	6.58(42.33)
15	Weedfree	----	----	1(0)	1(0)	1(0)
16	Weedycheck	----	---	7.77(59.67)	9.08(81.67)	8.97(80.33)
S.Em+				0.35	0.56	0.23
LSD(P=0.05)				1.01	1.62	0.68

The figures in parentheses are original values; *fb*= followed by

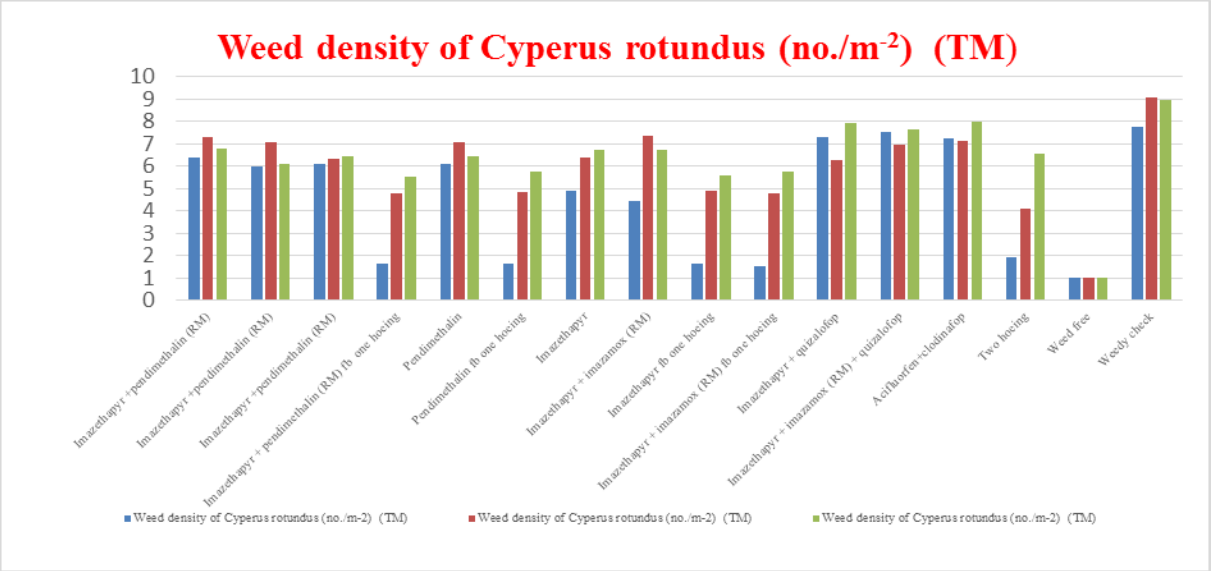

Figure 1. Effect of different herbicides on weed density of *Cyperus rotundus* (no./m^{-2}) (Transformation).

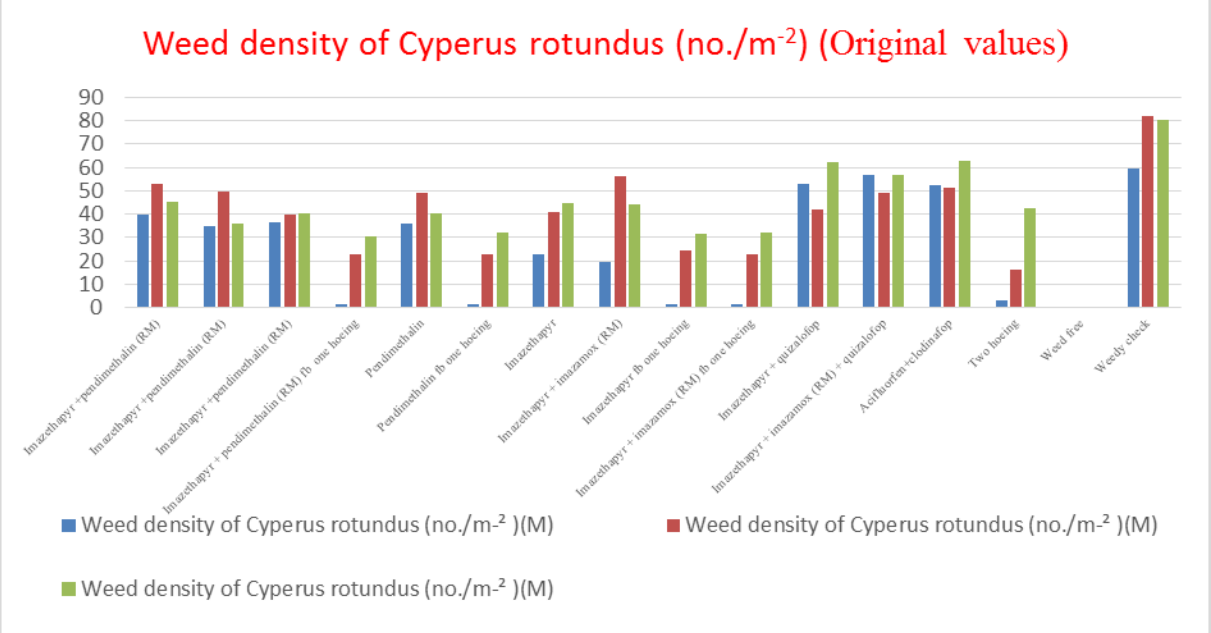

Figure 2. Effect of different herbicides on weed density of *Cyperus rotundus* (no./m^{-2}) (original values).

(II) Pod yield (kg/ha)

A very significant impact of herbicidal treatments was observed on groundnut pod yield. All the treatment affected the pod yield of groundnut at different levels. Among all the treatments as discussed in table 2 weed free treatment provided a favorable environment having the maximum pod yield of 2490 kg ha^{-1}. In comparison to this, an increased pod yield of 1285 kg $ha^{-1}$was reported over weedy check. The pod yield among various treatments ranged from 1205 to 2490 kg ha^{-1}. From the table it can be further analyzed that crop grown under weed free conditions reported the highest pod yield (2490 kg/ha), though it remained at par with that grown in imazethapyr + pendimethalin (RM) *fb* one hoeing 1000 g ha^{-1}(2385 kg ha^{-1}) as pre at 30 DAS and imazethapyr + pendimethalin (RM) 1500 g ha^{-1} (2370 kg ha^{-1}) as pre while the lowest pod yield (1360 kg ha^{-1}) was recorded with imazethapyr 70 g ha^{-1} and imazethapyr+ quizalofop 70+50gha^{-1} applied as post i.e. 1370 and 1360 kg ha^{-1}.These results were in close conformity with Mahajan *et al*. (2020) and Singh *et al*. (2017).

(III) Biological yield (kg/ha)

As per the data observed from Table 2, all herbicidal treatments tend to increase the biological yield over weedy check. Results reported pointed that the biological yield (kg) amongvarious treatments ranged from 2892 to 5727 kg ha^{-1}. The crop grown under weed free conditions had the highest biological yield of 5727 kg ha^{-1}.Among other herbicidal treatments imazethapyr + pendimethalin (RM)1000gha^{-1} at pre-emergence *fb*onehoeingat 30DAS(T_4) recorded the maximum biological yield of 5108.50 kg ha^{-}

[1],whilethe lowest biological yield of 3228 kg ha^{-1} was recorded under imazethapyr 70g ha^{-1} (T_7) and imazethapyr + quizalofop70+50gha^{-1} (T_{11}) applied as post.

(IV) Harvest index (%)

The per cent harvest index is presented in table 2, the results revealed that herbicidal weed management practices that harvest index was the maximum in imazethapyr + pendimethalin (RM) 1250g ha^{-1} (45.54per cent) followed by imazethapyr + pendimethalin (RM) at 1000, 1500 and 1000g ha^{-1} followed by one hoeing and the lowest harvest index (39.56 percent) was recorded in acifluorfen +clodinafop @305gha^{-1}and imazethapyr+quizalofop (70+50g ha^{-1}). Conclusion Based on the above discussion, it is concluded that pre-emergence application of imazethapyr + pendimethalin (RM) @1000 g ha^{-1}*fb* one hoeing at 30 DAS was effective control of *cyperus rotundus*and provided highest pod yield of groundnut.

Table 2. Effect of different herbicide treatments on pod yield (kg/ha), biological yield (kg/ha) and harvest index (%) on groundnut

Sr. No.	Herbicides	Dose(g/ha)	Time of application	Pod yield(kg/ha)	Biological yield(kg/ha)	Harvest index(%)
1	Imazethapyr+pendimethalin(RM)	1000	PRE	2265	4,756.50	44.54
2	Imazethapyr+pendimethalin(RM)	1250	PRE	2310	4,851.00	45.54
3	Imazethapyr+pendimethalin(RM)	1500	PRE	2370	4,977.00	44.21
4	Imazethapyr+pendimethalin (RM)*fb* onehoeing	1000	PRE,30DAS	2385	5,108.50	44.21
5	Pendimethalin	1000	PRE	1980	4,752.00	41.22
6	Pendimethalin*fb* onehoeing	1000	PRE,30DAS	2070	4,761.00	41.16
7	Imazethapyr	70	PRE	1370	3,288.00	41.56
8	Imazethapyr+imazamox(RM)	70	PRE	1680	4,032.00	41.22
9	Imazethapyr*fb*onehoeing	70	PRE	1530	3,672.00	41.56
10	Imazethapyr+imazamox(RM)*fb*onehoeing	70	PRE,30DAS	1590	3,816.00	41.56
11	Imazethapyr+quizalofop	70+50	POST	1360	3,264.00	39.56
12	Imazethapyr+imazamox(RM)+quizalofop	70+50	POST	1440	3,456.00	41.56
13	Acifluorfen+clodinafop	305	POST	1530	3,672.00	39.56
14	Twohoeing		25 & 45DAS	1860	4,278.00	40.83
15	Weedfree	----	---	2490	5,727.00	40.83
16	Weedycheck			1205	2892.00	38.89
S.Em±				69.06	128.44	----
LSD(P=0.05)				200.43	372.75	----

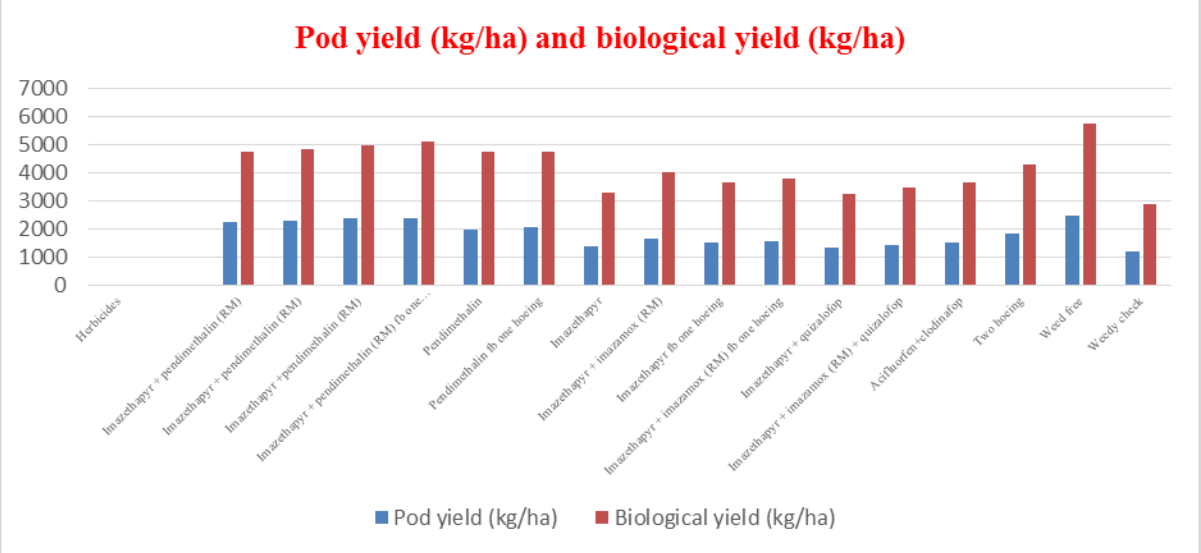

Figure 3. Effect of different herbicide treatments on pod yield (kg/ha) and biological yield(kg/ha).

CONCLUSIONS

Based on the above discussion, it is concludedat 60 DAS lower density of *Cyperus rotundus* was obtained from treatment T_{14} (two hoeing at 25 and 45 DAS) and it was statistically at par with pre-emergence application of imazethapyr + pendimethalin (RM) @1000 g ha^{-1}*fb* one hoeing (T_4). At 90 DAS, treatment T_4 in which imazethapyr + pendimethalin (RM) was applied as pre emergence @ 1000 g ha^{-1}*fb* one hoeing recorded significantly the minimum population of *Cyperous rotundus* in comparison to other treatments.The (T_4) imazethapyr + pendimethalin (RM) *fb* one hoeing 1000 g ha^{-1} at 30DAS was provided yield of groundnut 2385 kg ha^{-1} .

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