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Pre and post - emergence herbicides with cultural practices on weed management in soybean - pigeonpea intercropping system under middle Gujarat conditions

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Abstract
To study the "pre and post-emergence herbicides with cultural practices on weed management in soybean-pigeonpea intercropping system under middle Gujarat condition", an experiment was conducted at Agriculture Research Station, Anand Agricultural University, Derol, Dist: panchmahal, Gujarat, India during *kharif* seasons of the years 2017-18 and 2018-19. Ten treatments for weed management were studied in randomized block design with four replications. Result of field experimentation, it seems quite logical that potential production, profit and economic weed management can be achieved in soybean - pigeonpea intercropping system by interculturing + hand weeding at 20 & 40 DAS or post-emergence application of imazamox 35% + imazethapyr 35% (Pre mix)70 g ha^{-1}PoE *fb* interculturing + hand weeding at 30 DAS.

Keywords: Soybean, pigeonpea, weed control, herbicide and soybean equivalent yield

Introduction
Soybean considered as the 'Miracle crop or Wonder legume'. It has outstanding nutritive value with 43% biological protein, 20% oil and is also very rich in vitamins, iron, mineral, salts and amino acids (Sangeetha *et al.* 2013) [15]. Pigeonpea (*Cajanus cajan* (L.) Millsp.) commonly known as red gram, tur or arhar is the fifth prominent legume crop in the world.It has been recognized as a valuable source of protein for the vegetarians in their daily diet. It is grown as sole crop or intercrop with urdbean, mungbean, castor, sorghum, soybean, cotton, maize and groundnut in different states like Maharashtra, Karnataka, Andhra Pradesh, Gujarat, Jharkhand, Rajasthan Odisha, Punjab and Haryana. In rainy season weeds come in 2-3 flushes and growth is very fast therefore, they compete for light, nutrient, and space and are responsible for considerable reduction in yield. Weeds caused 80% reduction in pigeonpea grain yield if weeds were allowed to grow till harvest, however, grain yield losses were only 38% in pigeonpea + soybean intercropping system (Talnikar *et al*. 2008) [19].
Intercropping is the agricultural practice of growing two or more crops simultaneously on the same field with a definite row proportion. Weed suppression, the reduction of weed growth by crop interference, has been referred as one determinant of yield advantage of intercropping. The first 20-40 days period after sowing of soybean is considered to be critical with respect to weed crop competition. Weed competition during this period may lead to 40-70% reduction in the seed yield of soybean (Bhan, 1975) [2] depending upon the weed species present. Weeds are known to cause 40-64% reduction in pigeonpea yield. The critical period of crop weed competition for pigeonpea is 4-8 weeks (Ali, 1992) [1]. Among various constraints in crop production weed control is important one but generally neglected by many farmers. The crop yield loss is 20 to 77 per cent due to weeds (Kurchania *et al*. 2001) [10]. Inter cropping suppress the growth of weeds up to 25% (Sobney *et al*. 1989) [17]. It is very essential to find out alternative to manual labour for weed control, which has more weed control efficiency. At present many promising and selective herbicides are available which can control weeds effectively. Therefore, the present study was conducted to study the pre and post-emergence herbicides with cultural practices on weed management in soybean - pigeonpea intercropping system under middle Gujarat condition.

Materials and Methods

The field experiment was carried out to study the pre and post-emergence herbicides with cultural practices on weed management in soybean - pigeonpea intercropping system under middle Gujarat condition. The experiment was conducted at Agriculture Research Station, Anand Agricultural University, Derol, Dist: Panchmahal, Gujarat, India during *kharif* seasons of the years 2017-18 and 2018-19.The ten weed control treatments were studied *viz*.,pendimethalin 1000 g ha^{-1}PE *fb* interculturing + hand weeding at 30 DAS, clomazone 1000 g ha^{-1}PE *fb* interculturing + hand weeding at 30 DAS, imazethapyr 75 g ha^{-1}PoE *fb* interculturing + hand weeding at 30 DAS, propaquizafop 75 g ha^{-1} PoE *fb* interculturing + hand weeding at 30 DAS, quizalofop ethyl 50 g ha^{-1}PoE *fb* interculturing + hand weeding at 30 DAS,fenoxaprop-p-ethyl 100 g ha^{-1} PoE *fb* interculturing + hand weeding at 30 DAS, imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* interculturing + hand weeding at 30 DAS, sodium acefluorfen 16.5% + clodinafop propargyl 8% EC (Pre-mix) 80+165 PoE *fb* interculturing + hand weeding at 30 DAS, interculturing + hand weeding at 20 & 40 DAS and weedy check. The experiment was laid out in Randomized Block design with four replications. The plot size was 3.6 x 6.0 m. The soil of the experimental field was sandy loam in texture having low in organic carbon and nitrogen, medium in available phosphorus and high in potassium. Pendimethalin and clomazone was applied as pre emergence while imazethapyr, propaquizafop, quizalofop ethyl, fenoxaprop-p-ethyl, imazamox 35% + imazethapyr 35%and sodium acefluorfen 16.5% + clodinafop propargyl 8% EC were applied as post emergence with flat fan nozzle using 500 litre water per hectare. The soybean variety NRC 37 and pigeonpea variety AGT 2 were used in the experiment as a test crop. All the recommended agronomic practices were followed for raising the crop during both the years of experimentation. The observations on weed count, weed dry weight and weed control efficiency was recorded. The seed and stover equivalent yield was recorded from the prevailing market price on the basis of pooled yield data and benefit cost ratio were calculated. Weed data were square-root transformed before statistical analysis. Pooled analysis of two years was done and comparison were made at 5% level of significance.

Results and Discussion

Weed flora

The experimental field was infested with *Echinochloa crusgalli* L.,*Eragrostis major* L. *Digitaria sanguinalis* L.and *Cynodon Dactylon* L. as a monocot weeds (48.6%), while *Digera arvensis* L.,*Phyllanthus niruri* L. and *Launaea mudicauli* L. as a dicot weeds (37.2%) and *Cyperus Rotundus* L. as a sedge weed (14.1%), were the major weeds associated with the soybean and pigeonpea crop. Govind Prasad (2008) [4] also reported similar weed flora in soybean and Sing and Shekhon (2013) [16] in pigeonpea.

Effect on weed density and weed dry weight

The pooled data of two years presented in (Table 1) indicated that, all the weed control treatments significantly reduced the weeds count and weed dry weight when compared with unweeded control. Monocot weeds count was recorded at 40 DAS. Significantly less number of monocot weeds (1.00 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (3.42 no.m^{-2}), which was statistically at par with all other treatments except treatment T_{10} (weedy check). Significantly the maximum number of monocot weeds (6.76 no.m^{-2}) was recorded under treatment T_{10} (weedy check). Monocot weeds count (no.m^{-2}) was recorded at harvest of soybean. Significantly less number of monocot weeds (3.35 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_3 (imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (4.37 no.m^{-2}), which was statistically at par with all other treatments except treatment T_{10} (weedy check). Significantly the maximum number of monocot weeds (9.16no.m^{-2}) was observed under treatment T_{10} (weedy check). Similar, findings were also reported by Pandya *et al.* (2007) [14] and Govind Prasad (2008) [4] in soybean and Jadhav (2015) [7] in soybean + pigeonpea intercropping.

Dicot weeds count (no.m^{-2}) was recorded at 40 DAS. Significantly less number of dicot weeds (1.00 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (3.43 no.m^{-2}), which was statistically at par with all other treatments except treatmentT_1 (pendimethalin 1000 g ha^{-1}PE *fb* IC + HW at 30 DAS), T_2 (clomazone 1000 g ha^{-1}PE *fb* IC + HW at 30 DAS) andT_{10} (weedy check). Significantly the maximum number of dicot weeds (5.89 no.m^{-2}) was observed under treatment T_{10} (weedy check). Dicot weeds count (no.m^{-2}) was recorded at harvest of soybean. Significantly less number of dicot weeds (3.84 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (4.46 no.m^{-2}), which was statistically at par with treatments T_3 (imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (4.74 no.m^{-2}) and T_4 (propaquizafop 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (4.94 no.m^{-2}).Significantly the maximum number of dicot weeds (8.56 no.m^{-2}) was observed under treatment T_{10} (weedy check). Similar findings were obtained by application of imazethapyr 35%+imazamox 35% 75, 87.5 g ha^{-1}and imazamox (350 ml ha^{-1}) as early post-emergence produced better yield attributing characters compared to weedy check an account of maximum reduction in weed growth coupled with no inhibitory effects on soybean plants reported by Kothawade *et al.* (2007) [8] and Govind prasad (2008) [4] whereas similar findings reported in soybean+ pigeonpea intercropping by Jadhav (2015) [7].

Sedge weeds count (no.m^{-2}) was recorded at 40 DAS. Significantly less number of sedge weeds (1.00 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS)(2.73 no.m^{-2}), which was not statistically at par with all other treatments. Significantly the maximum number of sedge weeds (3.73 no.m^{-2}) was recorded under treatment T_{10} (weedy check). Sedge weeds count (no.m^{-2}) was recorded at harvest of soybean. Significantly less number of sedge weeds (2.85 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatments T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (3.14 no.m^{-2}), which was statistically at par with T_3 (imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (3.29 no.m^{-2}) and T_4 (propaquizafop 75 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (3.32 no.m^{-2}), except all other treatments. Significantly the maximum number of sedge weeds was (5.13 no.m^{-2}) observed under treatment T_{10} (weedy check). Similar

result was opined by Pandya *et al.* (2007) [14] and Habimana *et al*. [5] (2013).

Total weeds count (no.m^{-2}) was recorded at 40 DAS. Significantly less number of total weeds was (1.00 no.m^{-2}) recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (5.39 no.m^{-2}), which was statistically at par with T_3 (imazethapyr 75 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (5.64 no.m^{-2}) except all other treatments Significantly the maximum number of total weeds (9.63 no.m^{-2}) was recorded under treatment T_{10} (weedy check). Total weeds count (no.m^{-2}) was recorded at harvest of soybean. Significantly less number of total weeds (5.67 no.m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (6.86 no.m^{-2}), which was statistically at par withT_3 (imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (7.12 no.m^{-2}) and T_4 (propaquizafop 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS)(7.31no.m^{-2}), except all other treatments. Significantly the maximum number of total weeds (13.57 no.m^{-2}) was observed under treatment T_{10} (weedy check). Similar result was opined by Pandya *et al.* (2007) [14] and Kundu *et al*. (2011) [9] in soybean.

The minimum numbers of weeds was obtained under treatment T_9 (IC + HW at 20 & 40 DAS) at 40 DAS and at harvest this was evident due to practically least weed emergence after cultural operation. The minimum weed population recorded under these treatments was due to efficiency of herbicides to control weeds at early stage and later on through weeding and interculturing operation done at 40 DAS cause the least emergence of weeds and hence, minimum weed population. In addition to dense crop might have smothering effect on weeds. These finding corroborate the result reported by Pandya *et al.* (2007) [14], Kundu *et al*. (2011) [9] and Habimana *et al*. (2013) [5] in soybean, whereas similar findings reported in soybean+ pigeonpea intercropping by Jadhav (2015) [7].

Results on dry weight of weeds recorded at harvest soybean were significantly influenced due to different weed management practices. Significantly less number of monocot weeds dry weight (2.35 g m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS). The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (3.05 g m^{-2}), which was statistically at par with all other treatments except treatment T_{10} (weedy check). Significantly the maximum number of monocot weeds dry weight (6.42 g m^{-2}) was observed under treatment T_{10} (weedy check). Significantly less number of dicot weeds dry weight (2.74 g m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS)which was statistically at par with treatment T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (2.94 gm^{-2}), except all other treatments Significantly the maximum number of dicot weeds dry weight (10.10 g m^{-2}) was observed under treatment T_{10} (weedy check).Significantly less number of sedge weeds dry weight (1.62 g m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS) which was statistically at par with treatment T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (1.65 g m^{-2}), T_3 (imazethapyr 75 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (1.69 g m^{-2}) and T_4 (propaquizafop 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (1.73 g m^{-2}).Significantly the maximum number of sedge weeds dry weight was observed under treatment T_{10} (weedy check). Significantly less number of total weeds dry weight (3.71 g m^{-2}) was recorded by the treatment T_9 (IC + HW at 20 & 40 DAS) The next best treatment was T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (4.32 g m^{-2}),which was statistically at par with treatment T_3 (imazethapyr 75 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (4.53 g m^{-2}). Significantly the maximum number of total weeds dry weight (12.36 g m^{-2}) was observed under treatment T_{10} (weedy check). Similar result was opined by Pandya *et al*. (2007) [14], Kundu *et al*. (2011) [9], Habimana *et al.* (2013) [5] and Upadhyay *et al*. (2013) [20] in soybean, whereas similar findings reported in soybean + pigeonpea intercropping by Jadhav (2015) [7]. The results of the experiments showed that, dry matter of weeds in weedy check was maximum because of higher weed intensity and higher dry weight due to its dominance in utilizing the growth resources like sunlight, nutrients, moisture, CO_2 etc., weed free check recorded significantly lower dry weight at all the stages of pigeonpea. These result are in close conformity with those reported by Dhonde *et al.* (2009) [3], Sukhadia *et al*. (2000) [18] and Rao *et al*. (2015) [21].

Weed control efficiency (%)

The Data (Table 1) showed that weed control efficiency (91.9%) was recorded maximumin the treatment T_9 (IC + HW at 20 & 40 DAS (91.9%) followed by T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (88.8%) and treatment T_3 (imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS) (87.7%).Weed control efficiency was recorded higher in interculturing + two hand weeding at 20 & 40 DAS followed by application of imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS and application of imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS, were shown very effective in controlling broad leaf, grasses and sedges have arrested growth of most of the weeds, resulting in higher weed control efficiency and thus allowed the crop to grow more vigorously. Similar result was opined by Pandya *et al.* (2007) [14], Upadhyay *et al.* (2012) [20] and Habimana *et al*. (2013) [5] in soybean crop, whereas similar findings reported in soybean + pigeonpea intercropping by Jadhav (2015) [7].

Effect on seed and stover yield

Data regarding equivalent seed and stover yield (kg ha^{-1}) of soybean was recorded as influenced by weed management practices are presented in (Tables 2).The higher equivalent seed and stover yield of (3641kg ha^{-1}and 4944 kg ha^{-1}) was recorded under treatment T_9 (IC + HW at 20 & 40 DAS), which was statistically at par with treatment T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (3380 kg ha^{-1}and 4584 kg ha^{-1}). Significantly lowest equivalent seed and stover yield of (986 kg ha^{-1}and 1277 kg ha^{-1}) was recorded by the treatment T_{10} (weedy check). The soybean-equivalent yield was worked out considering price of soybean and pigeonpea. The observation on SEY kg ha^{-1} indicated that significant difference due to various treatments. Interculturing + hand weeding at 20 & 40 DAS recorded significantly higher SEY than all other treatments except application of imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1} PoE *fb* IC + HW at 30 DAS. The lowest SEY recorded in weedy check. Similar result was reported by Kushwah and Vyas (2005) [11] in soybean. Jadhav (2015) [7] and Ilhe *et al.* (2017) [6] in soybean-pigeonpea.

Economics

Data on economics of the different treatments presented in (Table 2) indicated maximum gross return and net return (` 114186 and 59999 ha$^{-1}$) was achieved under treatment $T_9$ (IC + HW at 20 & 40 DAS) and $T_7$ (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha$^{-1}$ PoE *fb* IC + HW at 30 DAS) (`105971 and 56351 ha^{-1}). The benefit cost ratio was also higher in T_7 (imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1} PoE *fb* IC + HW at 30 DAS) (2.14) followed by treatment T_9 (IC + HW at 20 & 40 DAS) (2.11). The treatment T_{10} (weedy check) had lowest benefit cost ratio (0.75) due to poor yield in this treatment. The results are in conformity with the results of Mishra *et al.* (2013) [12], Upadhyay *et al.* (2012) [20] and Moghal *et al.* (2014) [13].

Table 1: Weed density (no. m^{-2}) at 40 DAS and harvest, weed dry weight (g m^{-2}) at harvest and weed control efficiency (%) as influenced by different weed control treatments (pooled of two year)

Tr. No.	Treatment	Weed density (no. m^{-2}) at 40 DAS				Weed density (no. m^{-2}) at harvest				Weed dry weight (g m^{-2}) at harvest				WCE (%)
		Monocot	Dicot	Sedges	Total	Monocot	Dicot	Sedges	Total	Monocot	Dicot	Sedges	Total	
T_1	Pendimethalin 1000 g ha^{-1} PE *fb* IC + HW at 30 DAS	3.48^{b} (11.13)	4.11^{b} (16.00)	3.19^{b} (9.25)	6.11^{b} (36.4)	4.49^{b} (19.38)	5.48^{b} (29.3)	3.60^{b} (12.00)	7.84^{b} (60.6)	3.31^{b} (10.06)	3.57^{b} (11.81)	1.74^{cde} (2.03)	4.97^{b} (23.9)	85.1
T_2	Clomazone 1000 g ha^{-1}PE *fb* IC + HW at 30 DAS	3.51^{b} (11.38)	3.98^{bc} (15.00)	3.09^{bc} (8.63)	5.99^{b} (35.0)	4.46^{b} (19.25)	5.41^{b} (28.4)	3.58^{b} (11.88)	7.76^{b} (59.5)	3.27^{b} (9.85)	3.50^{b} (11.40)	1.82^{bcd} (2.36)	4.93^{b} (23.6)	85.2
T_3	Imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3.47^{b} (11.13)	3.61^{bc} (12.13)	2.93^{cd} (7.63)	5.64^{bc} (30.9)	4.37^{b} (18.38)	4.74^{b} (21.6)	3.29^{cd} (9.88)	7.12^{b} (49.9)	3.12^{b} (8.87)	3.14^{b} (8.90)	1.69^{de} (1.87)	4.53^{b} (19.6)	87.7
T_4	Propaquizafop 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3.53^{b} (11.50)	3.65^{bc} (12.38)	3.01^{bc} (8.13)	5.74^{bc} (32.0)	4.44^{b} (18.88)	4.94^{b} (23.6)	3.32^{bcd} (10.13)	7.31^{b} (52.6)	3.18^{b} (9.14)	3.37^{b} (10.51)	1.73^{de} (1.99)	4.75^{b} (21.6)	86.5
T_5	Quizalofop ethyl 50 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3.57^{b} (11.88)	3.69^{bc} (12.63)	3.16^{b} (9.00)	5.87^{bc} (33.5)	4.56^{b} (19.93)	5.15^{b} (25.6)	3.49^{bc} (11.25)	7.59^{b} (56.8)	3.21^{b} (9.32)	3.47^{b} (11.13)	1.87^{bc} (2.53)	4.89^{b} (23.0)	85.6
T_6	Fenoxaprop -p-ethyl 100 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3.69^{b} (12.75)	3.74^{bc} (13.00)	3.15^{b} (9.00)	5.98^{b} (34.8)	4.65^{b} (20.75)	5.19^{b} (26.1)	3.55^{bc} (11.63)	7.71^{b} (58.5)	3.22^{b} (9.41)	3.44^{b} (11.04)	1.95^{b} (2.81)	4.91^{b} (23.3)	85.5
T_7	Imazamox 35% + Imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3.42^{b} (10.75)	3.43^{c} (10.88)	2.73^{d} (6.50)	5.39^{b} (28.1)	4.38^{b} (18.25)	4.46^{b} (19.0)	3.14^{d} (9.00)	6.86^{b} (46.3)	3.05^{b} (8.34)	2.94^{b} (7.82)	1.65^{e} (1.72)	4.32^{b} (17.9)	88.8
T_8	Sodium acefluorfen 16.5% + Clodinafop propargyl 8% EC (Pre-mix) 80+165 PoE *fb* IC + HW at 30 DAS	3.58^{b} (11.88)	3.67^{bc} (12.50)	3.14^{bc} (8.88)	5.85^{bc} (33.3)	4.57^{b} (20.00)	5.11^{b} (25.3)	3.44^{bc} (10.88)	7.55^{b} (56.1)	3.19^{b} (9.24)	3.34^{b} (10.20)	1.74^{cde} (2.05)	4.73^{b} (21.5)	86.6
T_9	IC + HW at 20 & 40 DAS	1.00^{c} (0.00)	1.00^{d} (0.00)	1.00^{e} (0.00)	1.00^{d} (0.0)	3.35^{c} (10.25)	3.84^{b} (13.9)	2.85^{e} (7.25)	5.67^{b} (31.4)	2.35^{c} (4.61)	2.74^{b} (6.64)	1.62^{e} (1.63)	3.71^{b} (12.9)	91.9
T_{10}	Weedy check	6.76^{a} (44.75)	5.89^{a} (34.25)	3.73^{a} (13.00)	9.63^{a} (92.0)	9.16^{a} (84.00)	8.56^{a} (79.0)	5.13^{a} (25.38)	13.57^{a} (188.4)	6.42^{a} (40.76)	10.10^{a} (110.01)	3.18^{a} (9.10)	12.36^{a} (159.9)	-
	S.Em ±	0.09	0.19	0.06	0.15	0.30	0.75	0.08	0.66	0.20	0.87	0.04	0.82	-
	F Test. 5%	Sig.	Sig.	Sig.	Sig.	Sig.	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	-
	Interaction Y x T S.Em ±	0.13	0.13	0.09	0.12	0.17	0.18	0.12	0.17	0.11	0.12	0.06	0.12	-
	F Test. 5%	NS	Sig.	NS	Sig.	Sig.	Sig.	NS	Sig.	Sig.	Sig.	NS	Sig.	-
	CV%	7.25	7.19	6.20	4.04	7.05	6.75	6.53	4.43	6.38	6.29	5.96	4.44	-

Note: Data subjected to √(X+1) transformation, figures in parenthesis are means of original values, treatment means with the letter/letters in common are not significantly different by Duncan's New Multiple Range Test at 5% per cent level of significance

Table 2: Economics as influenced by weed management practices in soybean-pigeonpea intercropping system (pooled of two years)

Tr. No.	Treatment	Soybean equivalent yield		Gross return (`ha^{-1})	Cost of cultivation (`ha^{-1})	Net return (`ha^{-1})	B:C ratio
		Seed Yield (kg ha^{-1})	Stover Yield (kg ha^{-1})				
T_1	Pendimethalin 1000 g ha^{-1} PE *fb* IC + HW at 30 DAS	2708^{c}	3680^{d}	84931	49525	35406	1.71
T_2	Clomazone 1000 g ha^{-1}PE *fb* IC + HW at 30 DAS	2831^{c}	3837^{d}	88779	49232	39547	1.80
T_3	Imazethapyr 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3261^{b}	4425^{b}	102248	48908	53340	2.09
T_4	Propaquizafop 75 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3220^{b}	4370^{b}	100959	48849	52110	2.07
T_5	Quizalofop ethyl 50 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3199^{b}	4257^{bc}	100238	49444	50794	2.03
T_6	Fenoxaprop -p-ethyl 100 g ha^{-1}PoE *fb* IC + HW at 30 DAS	2878^{c}	3902^{cd}	90245	48816	41429	1.85
T_7	Imazamox 35% + Imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* IC + HW at 30 DAS	3380^{ab}	4584^{ab}	105971	49620	56351	2.14
T_8	Sodium acefluorfen 16.5% + Clodinafop propargyl 8% EC (Pre-mix) 80+165 PoE *fb* IC + HW at 30 DAS	3206^{b}	4349^{b}	100520	49931	50589	2.01
T_9	IC + HW at 20 & 40 DAS	3641^{a}	4944^{a}	114186	54187	59999	2.11
T_{10}	Weedy check	986^{d}	1277^{e}	30844	41151	-10307	0.75
Selling Price							
Seed: Soybean: ` 30.0 kg^{-1}				Stover: Soybean: ` 1.0 kg^{-1}			
Pigeonpea: ` 54.0 kg^{-1}				Pigeonpea: ` 2.0 kg^{-1}			

Conclusion

From Based on the result of field experimentation, it seems quite logical that potential production, profit and economic weed management can be achieved in soybean - pigeonpea intercropping system by interculturing + hand weeding at 20 & 40 DAS or post-emergence application of imazamox 35% + imazethapyr 35% (Pre mix) 70 g ha^{-1}PoE *fb* interculturing + hand weeding at 30 DAS.

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