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Research Article

Influence of Organic Mulches on Growth and Yield Components of Pea's Cultivars

[1]Muhammad Sajid, [1]Israr Hussain, [2]*Ijaz Ahmad Khan, [1]Abdur Rab, [1]Ibadullah Jan, [1]Fazal-i-Wahid and [1]Syed Tanveer Shah

[1]Department of Horticulture.
[2]Department of Weed Science, Khyber Pakhtunkhwa Agricultural University Peshawar, Pakistan.

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Corresponding Author
Ijaz Ahmad Khan
E-mail: *ijazahmadk@ hotmail.com*

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ABSTRACT

To study the influence of organic mulches on growth and yield components of pea's cultivars, an experiment was conducted at the Horticulture farm, Department of Horticulture, Khyber Pakhtunkhwa Agricultural University, Peshawar, in 2008. Different pea cultivars (Climax, Green feast and Peshawar local) were allotted to main plot and various mulching materials (sawdust, sugarcane leaves, persimmon leaves, wheat straw and weed check as control) were allotted to subplot. Different growth and yield parameters (% germination, number of pods, plant height (cm), pods yield kg ha^{-1} and fresh weed biomass) were significantly affected by different pea cultivars. In case of different mulching material showed significance for fresh weed biomass, number of pods, plant height and pods yield kg ha^{-1}. The interaction of organic mulches and pea's cultivars significantly influenced the % germination, plant height (cm), number of pods and pods yield kg ha^{-1} but showed a non-significant response to fresh weed biomass (kg ha-^{1}). The pea cultivar Greenfeast showed more % germination (96.07), number of pods (16.50), plant height (102.5 cm), pods yield kgha-^{1}(10497.80 kg) and less fresh weed biomass (289 kg ha^{-1}). Similarly among different mulching material the maximum number of pods (16.80) and pods yield (10638.67 kg ha^{-1}) were obtained in plants grown under the mulch of sawdust. Hence it is concluded that pea cv. Greenfeast having sawdust as mulching material showed best results regarding pea production and weeds control.

INTRODUCTION

The pea (*Pisum sativum* L.) belongs to family Leguminosae, is an important cool season vegetable. Pea originated from eastern Mediterranean region and near east. This crop was grown by Greeks and Romans as an important vegetable crop in the 11th century. Four possible centers of pea origin recognized are Abyssinia (Ethiopia), Mediterranean (Turkey, Greece, Yugoslavia and Lebanon), near eastern (Iran and Iraq) and central Asia (North West India, Pakistan, USSR and Afghanistan) (Sinha, 1997). Pea is an excellent human food, either eaten as vegetables or in soup. Cooked peas cv. Greenfeast is a rich source of protein. One pound of Greenfeast has 13.7 gm protein, 0.8 g fat and 36.1 g carbohydrate, 45 g calcium, 249 mg phosphorus, 54 mg ascorbic acid (Khan, 1994). The total area under cultivation of peas in Pakistan in 2009-2010 was 120.69 thousand hectares and the average yield was 71.239 thousand tons per hectare. The total area under cultivation of peas in Khyber Pakhtunkhwa in 2009-2010 was 1.26 thousand hectares and their production was 847 tones (dry peas whole) (Minfal, 2009).

Mulches decrease soil water evaporation, results in a more uniform soil moisture content and reduce the dose of irrigation water, which is very important in summer crops in dry areas of Pakistan. Mulching avoids the fluctuations in temperature in the first 20–30 cm depth in soils. This promotes root development and the soil temperature in the planting bed gets raised, promoting faster crop development and earlier harvest *(*Lamont, 1993*)*. The adverse effect of plastic mulch in agriculture is related to handling the plastic wastes and the associated environmental impact. Only a small percentage of the constantly rising amount of agricultural plastic waste is currently recycled because the process of recycling is expensive and time-consuming due to the high labor cost for the proper collection of the plastic films at the end of cultivation. A large portion of plastic films is left on the field or burnt uncontrollably by farmers, emitting harmful substances with the associated negative consequences to the environment (Scarascia-Mugnozza *et al*., 2006).

Fresh and dry weight of vegetables were also significantly increased by organic mulching because the high soil moisture under mulch cover encourage optimal transpiration, nutrient uptake and increase rate of photosynthesis require for plant growth. The soil moisture content under sawdust is consistently higher than in others; it ensures better coverage of the soil surface thereby reducing evaporation of the soil moisture (Adetuji, 1990).

Being a good producing area, the present research work was designed to make a comparative study of local as well as exotic cultivars of peas under the agro-climatic condition of Peshawar valley, Pakistan in order to control the weed infestation biologically and obtain high yield of pea.

MATERIAL AND METHODS

To study the influence of organic mulches on growth and yield components of pea's cultivars, an experiment was conducted at Horticulture Farm, Department of Horticulture, Khyber Pakhtunkhwa Agricultural University Peshawar in 2008. The experiment was laid out in RCBD (Randomized Complete Block Design) with split plot arrangement having two factors (Organic mulches and Pea's cultivars), replicated three times. The soil was ploughed two times with cultivator and planked to get a fine seedbed. After the soil and seedbed preparation the seeds of pea cultivars were sown in well- prepared main plots. Sowing was done on dated 15 November, 2008 with row- to- row distance 30 cm and placed seed within the rows at distance of 15 cm. Sowing was completed at optimum field conditions, and all required agronomic practices were kept constant. Then different organic mulching material (sawdust, sugarcane leaves, wheat straw, persimmon leaves and weed check as a control) were applied to the sub plots. The whole bed was covered with given mulches excluding the seed place which was left uncovered for the purpose of germination. When growth reached 8 cm, pea sticks were used for supports. The experiment consisted of two factors as pea cultivars (Climax, Greenfeast, Peshawar local) allotted to main plot whereas, mulching material (Saw dust, Sugarcane leaves, Persimmon leaves, Wheat straw, Weed check as Control) subjected to sub plots. The data was recorded on the following parameters.

Germination percent

Fifty percent germination for each treatment in each replication was recorded at four true leaves growth stage, using the formula below.

$$\% \text{ Germination} = \frac{\text{No. of germinated seeds}}{\text{Total No. of Seeds Planted}} \times 100$$

Fresh weed biomass (kg ha^{-1})

For fresh weed biomass, central row was weeded out thoroughly along with their roots. The root system having

soil particles were thoroughly cleaned and washed with tape water and then air- dried. They were put in polyethylene bags and weighted with the help of electronic digital balance. The data was collected and converted to the weight kg ha^{-1} with the help of the following formula.

$$\text{Fresh weed biomass (kg ha}^{-1}) = \frac{\text{weed biomass (kg) from net plot} \times 10{,}000}{\text{Area harvested (m}^2)}$$

Plant height (cm)

Data regarding plant height of pea cultivars of randomly 10 selected plants was recorded with the help of measuring tape from tip to soil surface of the plant (cm), for each treatment in each replication and their average was calculated.

Number of pods plant^{-1}

Ten plants of each treatment were randomly selected, and the number of pods of each plant was counted and their average was calculated.

Pods yield (kg ha^{-1})

Fresh pod yield from first picking to last picking was taken for all treatments in each replication with the help of physical balance and their average was calculated. Finally, the means were computed and converted to the yield kg ha^{-1} by the following formula:

$$\text{Yield ha}^{-1} = \frac{\text{Yield Plot}^{-1}}{\text{Area of Plot (m}^2)} \times 10000\ \text{m}^2$$

Statistical procedure

The data recorded on different parameters were subjected to Analysis of Variance (ANOVA) technique to find out the difference between the different treatments and their interactions. In cases where differences were found significant, the means were compared for differences using Least Significant Difference (LSD) test. Statistical computer software, MSTATC (Michigan State University, USA), was applied for computing both the ANOVA and LSD (Steel *et al.,* 1997).

RESULTS AND DISCUSSION

Germination percent

The maximum percent germination was recorded in Greenfeast (96.7) while the lowest germination percentage (50 %) noted in cultivar (Table 1). Analysis of variance showed that percent germination was significantly affected by cultivars whereas the interaction between pea cultivars and mulches also showed significant result. However, the different organic mulches used had non-significant effect on percent germination of pea's cultivars. The interaction between cultivars and mulches influenced significant results; highest percent germination was recorded (97.77 %) in Greenfeast mulched with sawdust. In case of mulching material highest percent germination was recorded in Persimmon leaves (77.27 %) and lowest was observed in sugarcane leaves (73.32 %). The highest percent germination in Greenfeast is due to the genetic properties that make it possible for them to have best germination %age than other cultivars. The significant results of cultivars and their interaction with mulches were due to optimum temperature and suitable climate for better germination of Greenfeast provided by sawdust. The result was in agreement with Ramakrishna *et al.* (1991), who found that mulches retained the soil moisture for longer period of time and also increased the soil temperature, retarded the loss of soil moisture and check the weed growth, were the key factors contributing to the germination and production of groundnut.

Table 1: Effect of mulching and cultivars on germination (%) of peas

Mulching	Cultivars			
	Climax	Greenfeast	Peshawar local	Mean values
Control	87.40	97.40	42.22	75.67
Sugarcane leaves	69.62	96.29	54.07	73.32
Persimmon leaves	88.88	94.81	48.14	77.27
Wheat straw	79.99	94.07	55.55	76.53
Sawdust	71.84	97.77	53.32	74.31
Means	79.55 b	96.07 a	50.66 c	

LSD Value at P < 0.5 for cultivar = 7.053, for interaction = 10.79

Fresh weed biomass (kg ha^{-1})

Data regarding fresh weed biomass are presented in Table 2. The mean value of the table showed that the pea's cultivars significantly influenced the fresh weed biomass. However, more fresh weed biomass (478.33kg ha^{-1}) was recorded in Climax and less was noted in Greenfeast (289 kg ha^{-1}), which is at par with Peshawar local (299.33 kg ha^{-1}). The different organic mulches substantially influenced the fresh weed biomass. The highest fresh weed biomass (560.40 kg ha^{-1}) was recorded in control as compared to sugarcane leaves (255.93 kg ha^{-1}) which is non-significantly different from persimmon leaves and wheat straw. Due to the maximum percent germination of Greenfeast and nutrients competitions with different weeds cause suppression in Greenfeast plots than in climax. The result was in agreement with Sanchez *et al.* (2008) that weed populations were highest in control plots and lowest in those in organic mulch. Our findings were also supported with James *et al.* (2006*);* he stated that mulches were more effective in controlling weeds as compared to herbicides.

Table 2: Effect of mulching and cultivars on fresh weed biomass (kg ha^{-1}) of peas

Mulching	Cultivars			
	Climax	Greenfeast	Peshawar local	Means
Control	615.375	548.710	517.157	560.408 a
Sugarcane leaves	405.627	177.073	185.093	255.931 c
Persimmon leaves	406.930	271.903	195.343	291.392 bc
Wheat straw	436.950	156.847	218.753	270.850 bc
Saw dust	526.780	292.400	380.310	399.830 b
Means	478.329 a	289.387 b	299.331 b	

LSD Value at P < 0.5 for cultivar = 107.5, for mulches = 133.5

Plant height (cm)

Data regarding plant height is presented in Table 3. Analysis of variance showed that plant height was highly significantly affected by both pea cultivars and organic mulching materials. However, the interaction between pea cultivars and organic mulching materials also shows significant results. A significant effect was seen regarding plant height of pea cultivars. However, the maximum plant height were recorded (102.5 cm) in Greenfeast, followed by Climax (95.46 cm) while minimum (75.29 cm) in Peshawar local. The mean value of organic mulches also showed significant results to the plant height of pea's cultivar, higher plants (94.90 cm) were recorded in sugarcane leaves, followed by Persimmon leaves (94.41), while shorter plants (84.28 cm) were recorded in control. The maximum value for plant height in Greenfeast was due to its genetic makeup

and used the available resources very efficiently. Similarly, the maximum plant height in sugarcane leaves is due to maximum soil moisture conservation to reduce water stress. The result was in agreement with Makus *et al.* (1994) who observed that plant height was significantly affected by different mulching material. He reported that mulch application increased plant height while reducing weeds competition.

Table 3: Effect of mulching and cultivars on plant height (cm) of peas

Mulching	Cultivars			
	Climax	Greenfeast	Peshawar local	Means
Control	85.60	96.10	71.15	84.28 b
Sugarcane leaves	93.92	110.00	80.78	94.90 a
Persimmon leaves	100.75	103.90	78.58	94.41 a
Wheat straw	94.33	97.08	78.00	89.82 ab
Saw dust	102.68	105.48	67.88	92.00 a
Means	95.46 b	102.50 a	75.29c	

LSD P < 0.5 for cultivar = 6.10, for interaction = 9.72, for mulches = 5.61

Number of pods plant^{-1}

Data regarding number of pods plant^{-1} is presented in Table 4. Analysis of variance showed that number of pods plant^{-1} was significantly affected by both cultivars and organic mulches, whereas the effect of interaction between organic mulches with pea cultivars also shows significant results. The mean value of the table showed that the pea's cultivars significantly influenced the number of pods plant^{-1}. However more number of pods plant^{-1} were recorded (16.50) in Greenfeast, while minimum (14.04) in Peshawar local. The interaction of pea's cultivars and mulches also significantly influenced the number of pods plant^{-1}. The significant difference of interaction of cultivars and mulches showed that highest (19.35) number of pods plant^{-1} was recorded in Greenfeast mulched with sawdust, while lowest (12.19) number of pods plant^{-1} was recorded in Peshawar local with control (no-mulched) plot. The mean value of the table showed that organic mulching material had influenced significantly on number of pods, highest (16.79) number of pods plant^{-1} was recorded in sawdust and lowest (13.28) in control. The reason for highest number of pods plant^{-1} in Greenfeast was due to its genetic character. The result was in agreement with Kabir and Iqbal (2006) who had almost the same grain yield for both climax and Greenfeast. In case of mulches more number of pods plant^{-1} were observed in sawdust treatment due to maximum soil moisture conservation, nutrient uptake, water holding capacity, and increase aeration of the soil. The result was in agreement with Makus *et al.* (1994) reported that mulch application increased pods number, while reducing weed competition.

Table 4: Effect of mulching and cultivars on numbers of pods plant^{-1} of peas

Mulching	Cultivars			
	Climax	Greenfeast	Peshawar local	Means
Control	14.36	13.30	12.19	13.28 d
Sugarcane leaves	15.33	17.92	14.61	15.95 b
Persimmon leaves	15.28	15.74	15.46	15.49 bc
Wheat straw	15.17	16.19	12.98	14.78 c
Saw dust	16.06	19.35	14.97	16.79 a
Means	15.24 b	16.50 a	14.04 c	

LSD P < 0.5 for cultivar = 0.926, for mulches = 0.834, for interaction = 1.446

Pods yield (kg ha^{-1})

The data in relation to Pods yield (kg ha^{-1}) presented in Table 5. Analysis of variance showed that pods yield (kg ha^{-1}) was significantly affected by both pea cultivars and organic mulches. Similarly, the interaction of organic mulches with pea cultivars also shows significant results. The mean value for cultivars showed that maximum pods yield (10497.80 kg ha^{-1}) was recorded in Greenfeast, while minimum pods yield (9938.93 kg ha^{-1})

in Peshawar local. In case of mulches high pods yield (10638.67 kg ha-^{1}) was recorded in sawdust while low pods yield (9771.89 kg ha^{-1}) was recorded in control plot. Whereas in interaction more (10786.00 kg ha-^{1}) pods yield kg ha^{-1} were recorded in Greenfeast with sawdust mulching plot. The reasons for highest Pods yield of different pea cultivars (10497.80 kg ha^{-1}) was due to maximum number of picking, pod length, maximum number of seeds pod^{-1} and less internodes distance of branches in Greenfeast. In case of mulches maximum pods yield kg ha^{-1} in sawdust is due to maximum soil moisture conservation and increased soil temperature. The results supported with Barker and Bhowmik (2001), who reported that application of plant residues was more effective in weed control and yield enhancement. The results were also in agreement with Adetuji (1990); he reported that fresh and dry weight of lettuce were significantly increased by organic mulching because the high soil moisture under mulch cover encourage optimal transpiration, nutrient uptake and increase rate of photosynthesis require for plant growth.

Table 5: Effect of mulching and cultivars on pods yield (kg ha^{-1}) of peas

Mulching	Cultivars			
	Climax	Greenfeast	Peshawar local	Means
Control	9883.00	9900.00	9532.67	9771.89 e
Sugarcane leaves	10526.00	10678.00	10340.67	10514.89 b
Persimmon leaves	10233.00	10761.67	9833.33	10276.89 c
Wheat straw	10029.67	10363.33	9530.00	9974.33 d
Saw dust	10672.00	10786.00	10458.00	10638.67 a
Means	10268.73 a	10497.80 a	9938.93 b	

LSD P < 0.5 for cultivar = 258.9, for mulches = 121.7, for interaction = 210.8

CONCLUSION

It is concluded from the experiment that among different pea cultivars Greenfeast showed best results for most of the growth and yield parameters. Among different mulching materials used in present experiment, the sawdust showed better results. Therefore, the pea's cultivar Greenfeast and sawdust as mulching materials were recommended for growers of Peshawar region, Pakistan on the basis of better growth and yield performance.

REFERENCES

Barker AV and Bhowmik PC (2001). Weed control with crop residues in vegetable cropping system, J. Crop Prod. 4 (2): 163-183.

Khan IA (1994). Introduction in horticulture. Publish by national book foundation Islamabad. Pp. 43-44.

Minfal (2009). Fruit, vegetables and condiments statistics of Pakistan. MINFAL. Economic wing. Islamabad. pp. 11-22.

Makus DJ, TiwarI SC, PearsoN HA, Haywood JD and Tirks AE (1994) Okra introduction with pine straw mulch. Agro forestry Sys. 27(2): 121-127.

Ramakrishna A, Ong CK and Reddy SLN (1991). Integrated weed management. For rain fed groundnut.J.PlantProt.Tropics8. pp. 111–119.

Sanchez E, Lamont WJ and Orzolek MD (2008). Newspaper mulches for suppressing weeds for organic high-tunnel cucumber production. Hort. teach. 18 (1): 154-157.

Scarascia-Mugnozza G, Schettini E, Vox G, Malinconico M, Immirzi B and Pagliara S (2006). Mechanical properties decay and morphological behavior of biodegradable films for agricultural mulching in real scale experiment. Polym. Degrade. Stabil. 91: 2801–2808.

Sinha SK (1997). Pea (*Pisumsativum*) in grain legume crops by Davies *et al (*1985). Mackays And chatham, kent, UK. Pp. 147-198.

Steel RGD, Torrie JH and Dickey DA (1997). Principles and procedures of statistics. A biometrical approach. McGrew-Hill publishing.

NOTE: The following authors were cited in the content but not listed as references

Adetuji, 1990; Bhowmik, 2001; Kabir and Iqbal, 2006; James *et al.,* 2006; Lamont, 1993

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