IIOAB JOURNAL

ARTICLE

EFFECTS OF PLANTING DATE AND TYPE OF MULCH ON ONION SEED YIELD OF AZARSHAHR CULTIVAR

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ABSTRACT

A split plot experiment using the randomized complete design was conducted in this research to study the effects of planting date and type of mulch on seed yield of the Azarshahr Onion cultivar. Planting dates were the main-plot factor at two levels (20 March and 3 April) and types of mulch the sub-plot factor at four levels (no mulch applied, transparent mulch, black mulch, wheat straw). Results of ANOVA of the data revealed that there were significant differences between the studied traits with respect to planting date, with the 20 March planting date being superior in most traits. The individual effects of mulch were significant on only a few of the studied traits such as seed yield and percentage of ripe umbles. However, the interaction effects of planting date and mulch on most of the studied traits were considerable, there were significant differences between the treatments with respect to traits such as stem height, number of remaining plants, diameter of umbles, seed yield per plant, seed yield per hectare, and 1000-seed weight and the treatments were superior to the control. The maximum seed yield (807.7 kg/ha) belonged to the treatment in which the planting date was 20 March and in which wheat straw was used, and the minimum (309 kg/ha) to the control treatment in which the planting date was 3 April and in which no much was applied. The lowest weed density was also observed in the treatment in which the 3 April planting date was used and black mulch was applied, while the highest weed density was that of the treatment with the 20 March planting date in which no mulch was used.

KEY WORDS
Edible onion, Mulch, Planting date, Seed production

INTRODUCTION

Edible onion is the most important bulb vegetable and ranks second after tomato among the 15 vegetables produced in greatest quantities in the world (Pathak, 2000). Onion seeds are the factor of highest importance in improving the quality and increasing the yield of onion crops, and high 1000-seed weight and germination ability of onion seeds are of great importance for onion producers (Ogawa et al., 1974). In addition to genetics, environmental factors such as temperature, rainfall, soil conditions, and presence of beneficial insects influence onion seed quality (Alleoni et al., 2010). Planting date and mulching are both very important factors in onion seed production, and roots of edible onion are very shallow and require continuous irrigation. Anisuzzaman et al. (2009) studied the effects of planting date and mulching on yields of Taherpuri cultivar of onion and reported both of these two factors had significant effects on most of the studied traits and the maximum seed yield (460.85) was obtained by planting on 21 November and it rose to 529.06kg/ha when mulch was applied. Shaikh et al (2002) stated improvement in seed quality was effective in increasing onion yield and increased it by 30 percent. Islam et al (2002) reported mulching and onion size had significant individual effects on plant height, number of leaves, number of false stems, stem diameter, root length, and number of roots. However, their interaction effects on number of leaves and on diameters of false stems were not significant. Mulching preserves moisture and thus is effective in reducing water loss. Igbadun et al. reported that application of rice straw and black plastic mulches increased water use efficiency in onion crops and annual onion yield was considerably influenced both by water shortage and by mulching. Therefore, considering the positive effects of mulching and the considerable effect of planting date on onion seed yield in research conducted by various researchers, the present study intended to investigate the positive effects of these two factors on edible onion seeds under the prevailing conditions in North Khorasan Province from 2011 to 2013..

Published: 10 October 2016

MATERIALS & METHODS

This split plot experiment with two factors was conducted with three replications. Planting dates at three levels (20 April, 4 May, 19 May) were the main-plot factor and various types of mulch (black plastic, white plastic, and plant residues) the sub-plot factor. Onions of the same size (8-10 gr) of the Azarshahr cultivar were planted 20-25 cm apart. The plots were 1 by 1 meter, and the main fertilizer was NPK applied to the soil at 150, 100, and 180 kg/ha, respectively. Half of the nitrogen together with all of the phosphorous and all of the potassium were applied during land preparation, and the other half of nitrogen at the appearance of flowering stems and the formation of umbles. Microfertilizers were applied if needed. The land used for the experiment was thoroughly plowed and leveled, and residues on soil surface were removed. A light irrigation was applied before spreading the mulch to make the soil surface uniform and moist. One week after planting the onions, and at emergence of the seedlings, the mulches were spread over the ridges and their edges were placed inside the furrows. In the control plots also, weeding was carried out several times during the growth and development of the plants and, during the growing season, pests and diseases were regularly controlled. When about 10 percent of the seeds inside the umbles became visible, the umbles were harvested. This was carried out in several stages, and the harvested seeds were kept under suitable dry conditions for their moisture levels to drop to 6-8 percent. The seeds were put in packets that were closed and kept at low temperatures. During the growing season, traits including heights of flowering stems, numbers of leaves and suckers, days to 50 percent flowering, number of flowers per umble, number of seeds per umble, 1000-seed weight, and seed yield were

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measured. ANOVA of the data was performed using MSTATC, comparison of the means was carried out employing Duncan' multiple range test, and graphs and diagr were drawn using EXCEL.

RESULTS

Results of ANOVA of the data [Fig. 1] showed planting dates had significant effects on most of the studied traits, and the 20 March planting date was superior to the 3 April planting date with respect to most of the traits. Results of comparison of the means also exhibited the clear superiority of the 20 March planting date over the 3 May planting date with respect to stem length, umble diameter, seed yield per umble, seed yield per plant, seed yield per plot, and seed yield per hectare [Fig. 2]. Contrary to planting dates, type of mulch had significant effects only on traits such as ripening of umbles, seed yield per hectare, and stem height, and the differences between the effects of the various treatments on the other traits were not significant [Fig. 1].

Comparison of the means also indicated the tallest stems (80.4 cm) belonged to the treatment of using black mulch, followed by the treatment of using wheat straw (80.3 cm), and the treatment of employing white plastic (80.2 cm), with the control treatment having the shortest stems (78 cm) [Fig. 1].

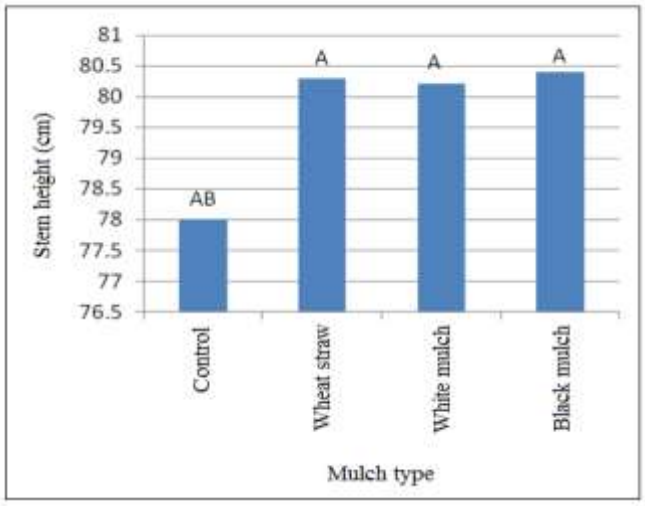

Fig. 1: The effects of type of mulch on height of flowering stems

The two planting dates and the types of mulch had significantly different effects on stem diameter at the 5 percent level, with the largest stem diameter (1.56 cm) belonging to the 20 March planting date and black mulch treatment, and the smallest (1.23 cm) to the 3 April planting date and the control treatment [Fig. 2].

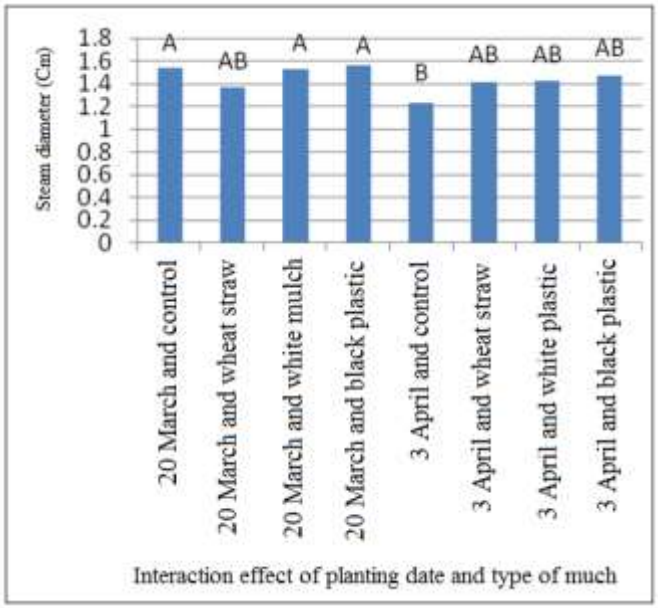

Fig. 2: The interaction effects of planting date and type of mulch on stem diameter

With respect to seed yield per plant, the highest yield was that of the 20 March planting date and wheat straw (15 gr), followed by the 20 March planting date and white plastic (11 gr) and 20 March and black

plastic (9.66 gr). The 3 April planting date and black plastic had the lowest seed yield per plant (5.33 gr) [Fig. 3].

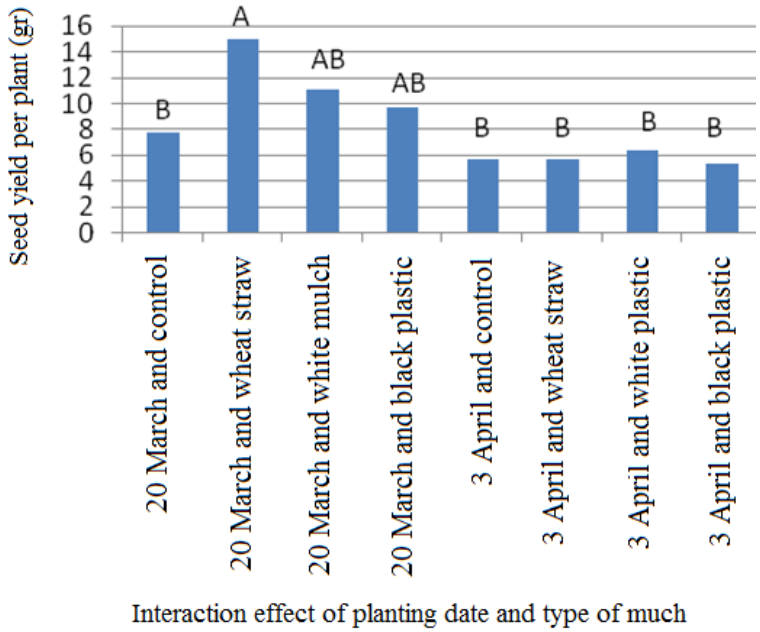

Fig. 3: Interaction effects of planting date and type of much on seed yield per plant

There were significant differences between the effects of the various planting dates and types of mulch on seed yield per hectare. Comparison of the means of the data [Fig. 4] indicated the maximum seed yield (807.7 kg/ha) was that of the 20 March planting date and wheat straw, followed by the treatment of the 20 March planting date and black plastic (739.7 kg/ha), and the 20 March planting date and white plastic (694.7 kg/ha). However, the differences between these three treatments were not statistically significant and they could be placed in the same statistical group. The minimum seed yield (309 kg/ha) belonged to the 3 April planting date and the control. In all, seed yields in the treatments with various types of mulch and the 20 March planting date were considerably lower [Fig. 4].

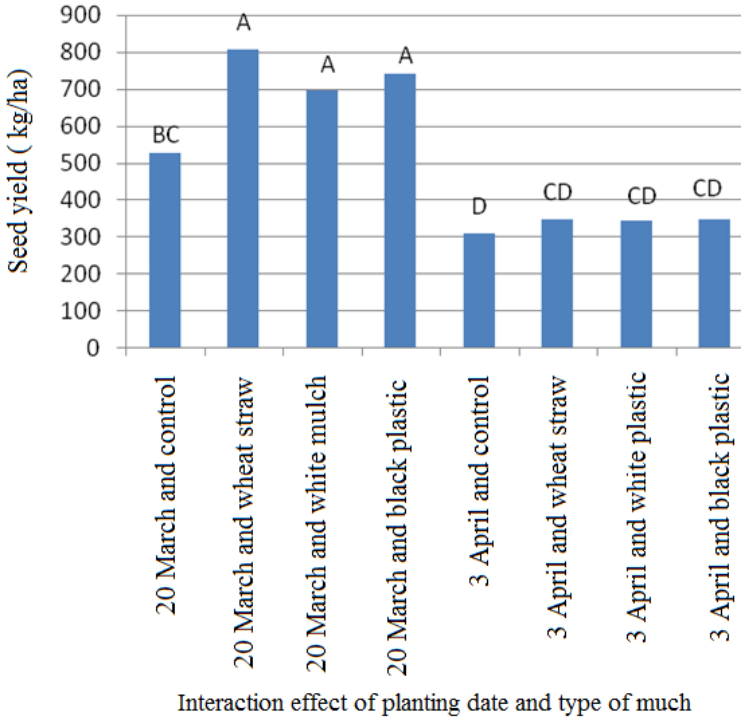

Fig. 4: The interaction effects of planting date and type of mulch on seed yield per hectare

The interaction effects of planting date and type of mulch on 1000-seed weight were significant, but the differences between the treatments were not very considerable and most treatments could be placed in the same statistical group [Fig. 5]

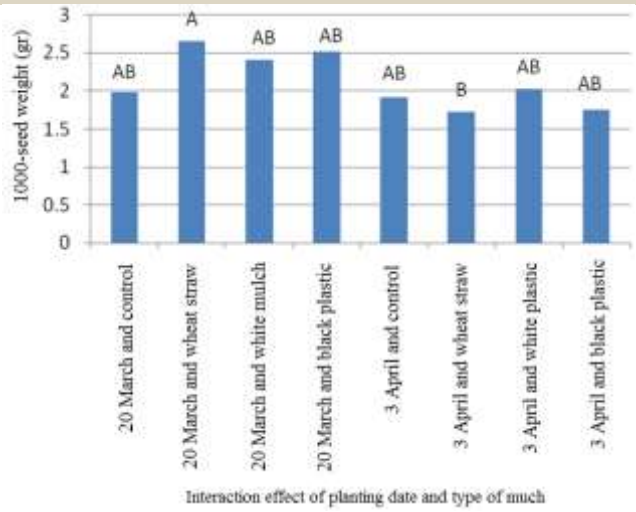

Fig. 5: The interaction effects of planting date and type of mulch on 1000-seed weight

The interaction effects of planting date and type of mulch on weed density were significant with the minimum weed density observed in the treatment with the planting date of 20 March and black plastic and the maximum in the treatment of the 3 April planting date and the control [Fig. 6].

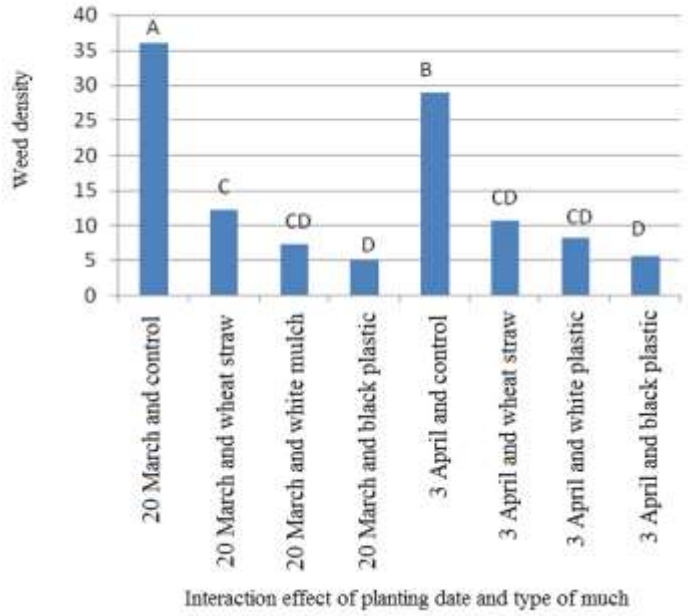

Fig. 6: The interaction effects of planting date and type of mulch on weed density

DICUSSION

In this research, planting date had considerable and significant effects on most of the studied traits. These results agree with those found by many other researchers. Mirshekari and Mobashsher (2006) reported planting date significatly influenced plant height, 1000-seed weight, perentage of remaining plants, umble diameter, yield per plant, and seed yield per hectare, with the best growth characteristics and the maximum seed yield (712.5 kg/ha) belonging to the 20 March planting date and the minimum (406.2 kg/ha) to the 22 October planting date. Anisuzzaman et al. (2009) also observed significant differences between the effects of planting dates on traits such as number of suckers, plant height, days to reach 50 percent flowering, umble diameter, seed yield per plant, and seed yield per hectare, with the largest umble diameter, seed yield per plant, and seed yield per hectare (460.8 kg/ha) belonging to the 21 November planting date and the smallest (335.7 kg/ha) to the 30 October planting date. In the present research, 1000-seed weight was also affected by the planting date and seeds planted on 20 March had higher mean 1000-seed weight (2.397 gr) compared to those planted on 3 April (1.887 gr) (Diagram 5). Mirshekari and Mobashsher (2006) reported significant differences between the effects of various

planting dates on 1000-seed weight, with the maximum 1000-seed weight (2.83 gr) being that of the 6 October planting date and the minimum (2.51 gr) that of the 20 March planting date. They stated that comparison of the components of seed yield related to the planting dates of 5 March and 20 March also revealed that seeds planted on 20 March were superior in most of the studied traits, and attributed this superiority to the cold weather and frost in the region the seeds planted on 5 March faced. They also observed the maximum remaining plants belonged to the 20 March planting date and fewer plants remained in the plots when seeds were planted in the autumn. Anisuzzaman et al. (2009) compared the planting dates of 30 October, 10 November, and 21 November and reported the maximum 1000-seed weight (3.48 gr) belonged to the 21 November planting date and the minimum (3.07 gr) to the 30 October planting date.

In the present research, contrary to reports of many other studies, the individual effects of the type of mulch on many of the traits were not significant, and these individual effects were only significant on seed yield per hectare and weed density, but the interaction effects of type of mulch and planting date were completely positive and significant on most of the studied traits. The different effects of mulch in the present research probably resulted from environmental conditions (there was substantial rainfall during the experiment), soil type (clay), and careless irrigation practices. The interaction effects of planting date and type of mulch on traits such as stem height, seed yield per plant, weed density, and seed yield per hectare were significant, and they were completely significant on seed yield (Diagram 4). Many researchers have reported positive effects of applying mulch, and also the interaction effects of mulch and other factors on growth and development of onions, and on components of onion seed yield (Mirshekari and Mobashsher, 2006; Anisuzzaman et al., 2009; Homa, 2013, and Rahman et al., 2013). Anisuzzaman et al. (2009) obtained the best components of seed yield such as stem height, number of suckers, number of umbles, seed yield per umble, per plant, and per plot, seed yield per hectare, and the least number of days to 50 percent flowering in the treatment of applying blach plastic as mulch, and mulching treatments exhibited significant differences with the control. Rahman et al. (2013) reported mulching had significant effects on the studied traits such as plant height, number of leaves, leaf dry weight, number of false stems, and roots. Homa (2013) studied the effects of planting date and type of mulch on growth and development of onions in Nigeria and reported that mulching had significant effects on traits such as plant height, number of suckers, and days to 50 percent flowering, and the differences between the treatments and the control were completely significant. One of the positive effects of mlches, especially of dark mulches, is that they control weeds. Since onion plants are week in the early stages of their growth, the effects of various types of mulches on weed control in this crop are very considerable. In the present research also, use of mulches had very significant effects ($P \leq 0.01$) on weed control, and the treatments had lower weed densities compared to the control, with the lowest weed density belonging to the black plastic treatment.

CONFLICT OF INTEREST
None

ACKNOWLEDGEMENTS
None

FINANCIAL DISCLOSURE
None

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