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Intercropping of Grass Pea with Barley under Irrigated Conditions

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Abstract: There is a short window after barley harvesting in Iranian highlands that is normally left as fallow till next growing season and we try to use this short period for grass pea and barley mix cropping. Three seeding rates of grass pea cv. Naghadeh local were studied as pure stand and mixing with already shattered barley seeds after barley harvesting in early July 2010. This experiment was carried out as randomized complete blocks design with three replications. Forage production and some quality related traits were evaluated when grass pea reached flowering stage that coincided with the initial creamy stages of barley. The analysis of variances showed that fresh biomass, calcium and fiber contents were significant ($P < 0.01$). The highest fresh biomass (45 ton/ha) was obtained in the mixture of barley with grass pea at 200 seeds/m². The highest fiber content (23.5%) and relatively low ash content (12.6%) was achieved in the mixture of barley with grass pea at 200 seeds/m² and the calcium percent in this treatment was not significantly different from sole grass pea. It was concluded that the mix cropping of barley with grass pea at 200 seeds/m² is the best combination after barley using a few irrigations.

Key words: Calcium · *Hordeum vulgare* · *Lathyrus sativus* · Fiber · Forage crops

INTRODUCTION

There are suitable opportunities to increase forage production without any decrease on other major crops cultivation area. Forage production could be increased using grass pea (*Lathyrus sativus*) and other neglected crops in the suitable agricultural systems. Forage crops could not be introduced or expanded in the place of any other crop such as cereals which are defined as strategic crops in the most countries including Iran [1]. It is necessary to look for new opportunities. Arable lands have been devoted to Cereals, mostly in the semi-arid region. There is a short window between harvesting of cereals in early July and planting of new crops in the early October which normally is left as summer fallow in semi arid regions of Iran. Mainly, there is no rainfall during July to late September in these areas [2]. It is possible to provide a little irrigation water in some areas where we need to produce some forage crops. However, selected crops should grow fast and complete the production cycle during maximum 60 days as the normal winter crops planting starts early October in these areas.

After harvesting of cereals including wheat and barley there is a considerable shattered seeds which are remained useless during summer and usually are collected by birds or insects [3]. The rate of shattering is high depending on harvesting method and depressed machinery however, it is believed that there is a minimum 5% shattering in barley and wheat [4]. Barley production rate is around 3000 kg/ha under irrigated conditions in semi-arid areas and its 5% shattering is optimum seeding rate in these areas. It sounds that by planting the suitable crops just after harvesting of cereals could alleviate the already shattered seeds to produce a mix cropping. Mixed cropping of cereals with forage legumes can improve both quantity [5] and quality of fodder over a pure cereal crop [5 and 7]. Considerable variation has been reported in forage yields of improved vetches (*Vicia* spp.) and grasspea (*Lathyrus* spp.) under semi-arid conditions [1]. Smooth vetch and grass pea could grow and complete flowering during 50-60 days which fits summer fallow, perfectly. Planting of grass pea with minimum tillage just after harvesting the cereals using a few irrigations could lead a mixture of cereals and legumes in order to enhance

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forage production. The objective of the present work was to evaluate the pure stands along with mixtures of already shattered barley seeds with a local variety of grass pea at three seeding ratio after barley harvesting.

MATERIALS AND METHODS

A field experiment was conducted at Malekan Agricultural Research Station in Northwest Iran during summer 2010. The area is subjected to marked dry season during summer with a little rainfall, rarely. Experimental field was prepared by chisel then replaced by an appropriate N-P fertilizer (40 kg/ha N + 20 kg/ha P_2O_5), which was applied uniformly to the soil just after harvesting of barley (cv. Makoii) in the mid July 2010.

This experiment was carried out as randomized complete blocks design with 7 treatments including 3 mixed and 4 pure stands with 3 replications. Seeds of grass pea (cv. Naghadeh local) at three density i.e 150, 200 and 250 seeds/m² were planted and were irrigated, immediately. Each plot size was 10 m^2. Pure stands of grass pea were created by eliminating of germinated barley and other weeds. Hay was harvested when grass pea initiated pod formation, which coincided with the milky stage of barley. At that time, samples from a randomly selected 1 m^2 area of each plot were cut to the ground level. Samples (0.3 kg) from each plot were taken for forage quality testing. These samples were dried in the oven at 70°C for 48 h and then were grounded to fine particles (<1 mm). The calcium was determined using flame photometry [8].

SPSS software was used to conduct analyses of variance (ANOVA). Treatment mean differences were separated by the Duncan's multiple range test (DMRT) at the 0.05 probability level.

RESULTS AND DISCUSSION

The analysis of variances showed that there was significant ($P < 0.01$) difference between treatments regarding all studied characteristics including fresh biomass, calcium and fiber contents. Harvesting took place at mid September 2010 and kept the required time for land preparing for subsequent winter crop. This guaranteed that there is no time interaction between grass pea and the major winter crops which could be limiting factor in the application of grass pea as suitable crop for this purpose.

Little information has been available regarding grass pea and its capacity for mixing with barley in order to forage production during summer. The results showed its potential for producing a recognizable biomass during summer in the north-west Iran. The Northwest of Iran is clustered as semi arid region and is known with its short spring and dry summer [6]. This study showed a variation for forage production potential among the different mixtures of grass pea with barley. The greatest fresh biomass (45.3 ton/ha) was obtained in the mixture of barley with grass pea at 200 seeds/m² (Fig. 1) which, was 50% more than pure barley yield (Fig. 1).

Quality related traits were superior in the pure stands of grass pea as expected. Grass pea produce high quality forage in pure stands however, its quantity is low and grass pea sole cropping may not be economic for cultivation in some areas [1]. It was interesting that mixture of grass pea with barley in this experiment could produce high quality forage as well as high biomass. The highest fiber content (23.5%) and relatively low ash content (12.6%) was achieved in the mixture of barley with grass pea at 200 seeds/m² (Fig. 2 and 3). The calcium percent in the mixture of barley with grass pea at 200 seeds/m² was not significantly different from pure grass pea stands (Fig. 4). This means that we can produce much forage with good quality using suitable seed density of grass pea.

It was concluded that planting of grass pea at 200 seeds/m² just after harvesting of barley could produce recognizable forage in the semi arid regions. It is an economic alternative in summer fallow and will enhance farmers' benefits in general and cattle feeding in specific. Nutritional assessment of grass pea and barley mix forage and recycling of the cereal grains falls including wheat by using vetches and grass pea as summer crop were planed to the future research.

Table 1: Analysis of variance on some studied characteristics in different mixtures of grass pea with barley

		MS				
SOV	dF	Fresh biomass	Plant height	Calcium %	Fiber %	Ash %.
Blocks	2	116.37	23.84**	0.003*	0.035	0.001
Treatments	6	126.67*	108.09**	0.02**	3.47**	4.96**
Error	12	42.47	3.66	0.0001	0.064	0.026

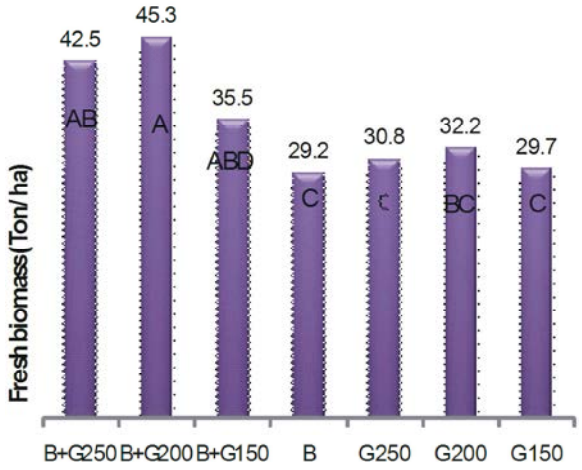

Fig. 1: Mean biomass production over different mixtures of grass pea (G) with barley (B). Means followed by the same letters are not significantly different according to DMRT (P <0.05) across all treatments

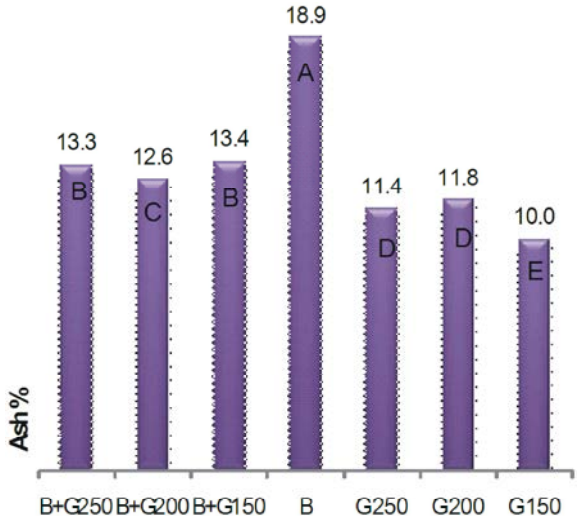

Fig. 2: Mean ash percent over different mixtures of grass pea (G) with barley (B). Means followed by the same letters are not significantly different according to DMRT (P <0.05) across all treatments

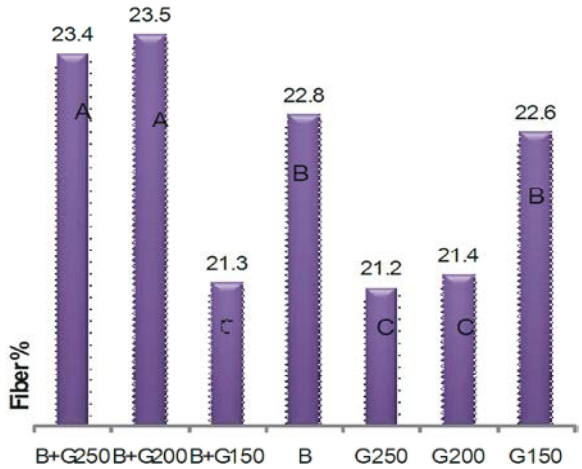

Fig. 3: Mean fiber percent over different mixtures of grass pea (G) with barley (B). Means followed by the same letters are not significantly different according to DMRT (P <0.05) across all treatments

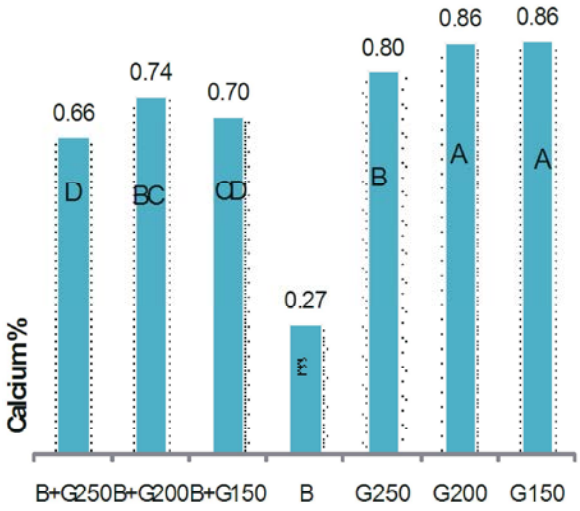

Fig. 4: Mean calcium percent over different mixtures of grass pea (G) with barley (B). Means followed by the same letters are not significantly different according to DMRT (P <0.05) across all treatments

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