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The performance of a new genus brassica forage crops with clover local cultivars in the climate of Ilam

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Abstract

The possibility of new forage brassica plants in Ilam were assessed as a randomized complete block design in four replications. The treatments included plants (Perko, Buko, clover, oilseed radish and combination of three plants(Ramtil, Phasilia, clover) respectively. The results showed that there were significant differences ($P \leq 0.01$) the forage yield and percentage of organic carbon after planting. There was observed significant difference ($P \leq 0.05$) in terms of plant height, total dry weight, protein content, protein yield, the yield of digestible protein. Perko varieties in terms of fresh and dry matter yield with 69,586 kg of fresh produce and 7147 kg dry matter and Buko varieties in terms of protein percentage and protein digestibility with 23.36 and 18.724 were superiority compared to the rest of the varieties.

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Introduction

Green manure-based systems may provide alternatives to current approaches to crop production; however, the use of green manure may not be economically justified without the provision of multiple services such as nutrient supply, pest and weed control, and improvement of soil characteristics for crop production, among others (Cherr *et al.*, 2007).

A green manure, a crop used primarily as a soil amendment and a nutrient source for subsequent crops, may provide such an alternative. Unlike synthetic N fertilizers, legumes utilized as green manure represent a potentially renewable source of on-farm, biologically fixed N and may also fix and add large amounts of C to cropping systems(Hargrove, 1986; Sharma and Mittra, 1988).

Green manures grown on site do not incur the often inhibitive handling and transportation costs of other organic inputs. The slow release of N from decomposing green manures residues may be better synchronized with plant uptake than sources of inorganic N, possibly increasing N-uptake efficiency and crop yield while reducing N leaching losses (Aulakh *et al.*, 2000; Cline and Silvernail, 2002).Green manure approaches may also drive long-term increases of soil organic matter and microbial biomass (Biederbeck *et al.,* 1998), further improving nutrient retention and N-uptake efficiency. When used in place of fallow, well-chosen green manures may reduce erosion, reduce nutrient or pesticide losses, and suppress weeds (Burgos and Talbert, 1996) and specific crop pests. Green manures may also offer habitat or resources for beneficial organisms (Gaston *et al.,* 2003).

Soil organic matter (SOM) plays an important role in maintaining the productivity of tropical soils because it provides energy and substrates, and promotes the biological diversity that helps to maintain soil quality and ecosystem functionality. SOM directly influences soil quality, due to its effect on soil properties (Wendling *et al.,* 2010).

The genus *Brassica*, there are about 160 species are mostly annuals and biennial. This genus plants of have good potential fodder. With the progress of science breeding have been produced new varieties supply oil and forage. Perko varieties are derived from crosses tetraploid plants of winter rapeseed *(Brassica napus L.varnapus)* and Chinese cabbage *(Brassica campestris L. var. sensulato)* and new plants is superior to their parents from various directions. Buko varieties are a new amphiploid plant obtained by crossing tetraploid winter rapeseed, Chinese cabbage and turnips *(Brassica campestris L. var. Rapa)*.Oilseed radish with scientific name *(Raphanus sativus L.)*is a genus of the *Brassica* and consumption, oil, green manure, feed and fodder (Kashani *et al.*,1986:Lupashku, 1980).This plants in many countries, including Canada, is cultivated in gardens in order to cover crop. Oilseed radish is growing quickly in the cool seasons. Ramtil*(Guizotia abyssinica)* belongs to the family *Compositae*, and Phasilia*(Phacelia tanacetifolia)* is a species of *Boraginaceae* family (Marianne, 1994) and clover is a legume and of *Fabaceae* family that is grown in order to feed.

The cultivation of Perko (tetraploid *Brassica napus* var. *oleifera* X tetraploid B. Chinensis) cv. PVH for fodder production are reported in Moldavia. It produced 55.8 t/ha fresh fodder and 5.76 t/ha dry matter; the regrowth in spring also gave high yields(Lupashku, 1980).

According to Karsli *et al.* (1999) Egyptian clover crude protein is 22%and fiber content in this crop has an average of 32 percent. Clark, (2007) has also reported that Egyptian clover contains 18-28 percent protein.

Considering that the cultivated varieties include (Perko, Buko, oilseed radish, Ramtil and Phasilia) were cultivated and studied for first time in Ilam, Iran, there were no available information on their growth, suitable planting time, pests diseases, etc. This study tried to compare the performance and costs of these imported varieties from Germany in

comparison with clover. And study Possibility of growing these plants in the climate of Ilam and choose the best kind of dry forage production, soil quality and increase the amount of protein.

Materials and methods

Experimental site and design

The field experiment was conducted from 2012 to 2013 at the Karezan region of Ilam, Iran (42°33′N, 33°46′ E) on a silty- clay with low organic carbon (1.26%and slightly alkaline soil (pH=7.9). Other soil test parameters are presented in Table 1.This site characterized by temperate climates with 370 mm annual precipitation.

Design and application of treatments

The experiment design was a randomized complete block design with four replications. The plant treatments was (perkoPVH, buko, clover, oilseed radish and combination of three plants Ramtil, Phasilia, clover).

After land preparation, including basic fertilization, tillage and leveling, planting scheme and experimental treatments were implemented. Planting was done with a row spacing of 20 cm and plot area was 30 square meters. At final harvest, we measured different plant traits such as fresh weight, dry weight, nitrogen percentage in plant tissues, protein content, plant height, etc.... Plant samples collected at harvest were separated into different plant parts and oven-dried at 60°C for 72h. A sub sample of biomass was analyzed for total N content using a micro- Kjeldahl digestion with sulfuric acid. The foliage protein content was obtained by multiplying the foliage N content (%) by 6.25 (Karsli, 1999). Then, the crude protein multiplied by 0.93 and the result was obtained the number 3.48 to reduce the amount of digestible protein, than values obtained in dry matter yield per hectare was calculated by multiplying the amount of weight.

The differences between the treatments were determined using analysis of variance (ANOVA). Mean comparisons were performed using Duncan`s multiple range test procedures by the SAS software.

Results and discussion

Biological yield

The results showed that the varieties used in the biological yield was significant ($P \leq 0.01$) (Table 2).The higher of biological yield belonged to Perko, oilseed radish and Buko, respectively with 69,59, 69,16 and 67,41 kg ha^{-1}, and the lowest biological yield was observed for berseem clovers pecies with 38,464 kg ha^{-1} (Table 3).Biological yield of oilseed radish and Perko were better than the other varieties. There were 81 percent increase for oilseed radish and 75 percent for Buko in their performance rate compared to Berseem clover forage in the region. Similar results were found in some researches (Kashani *et al.*, 1986: Lichner, 1990: Veneni and Axamit, 1980: Lvpashkvh, 1980).

Table 1. Results of soil tests implementation of experiment.

Soil depth (cm)	Soil Texture	P (ppm)	K(ppm)	N%	OC%	pH	EC(ds/m)
0-30	Silty- Clay	10.5	760	0.11	1.26	7.90	0.58
31-60	Silty- Clay	4.4	420	0.07	0.76	7.85	0.58

Total Dry Weight

The results showed that there was a significant difference in total dry weight,($P \leq 0.05$) (Table 2). The higher total dry weight was observed for Perko (7147.5kg ha^{-1}) and the lowest dry matter yield was belonged to the combination of three plants Ramtil, Phasilia, clover producing (4866 kg ha^{-1}) (Table 3).The results of this study showed a greater performance for Perko compared to Clover up to 76.44 percent. The results were similar to some previous researches (Kashani *et al.*, 1986: hamdi *et al.*, 1992: Lvpashkvh, 1980).

Percentage of dry matter

The results showed that the varieties used in the percentage of dry matter there was no significant difference (Table 2).The higher percentage of dry matter was observed for clover (13.03%) and the lowest amount was belonged to oilseed radish (9.69%) (Table 3).

Plant height

The results showed that between varieties of plant height was significant (Table 2).The highest and lowest plant height of cultivars observed in combination of three plants (Ramtil, Phasilia and clover) (58.15 cm) and oilseed radish (38.38 cm), respectively (Table 3).

Table 2. Analysis of variance of plant species studied.

S.O.V	df	Mean-square(M.S)								
		Biological yield	Total dry matter	Percentage of dry matter	Plant height	Nitrogen Percent	Proteinpercent	Digestible Percent protein	Amount total protein	Digestible amount protein
Replication	3	165379626^{ns}	954922^{ns}	1.581^{ns}	31.61^{ns}	0.311^{ns}	12.19^{ns}	10.54^{ns}	58058 ^{ns}	41792 ^{ns}
Treatment	4	¨828725925	˙4211174	11.61*	253.54*	0.568*	22.23*	˙19.22	184712*	119729*
Error	12	98432412	864995	2.061	55.93	0.152	5.964	5.158	62451	43083.8
Coefficient of - Variation(CV)		16.9	15.9	13.9	16.8	11.7	11.7	14.2	20.6	22.4

ns,* and **: No Significant and Significant at 5 and 1% level of probability, respectively .

Nitrogen Percent

The results showed that the varieties used in the nitrogen percent was significant (Table 2).The highest and lowest nitrogen percent of cultivars observed in Buko (3.82%) and oilseed radish (2.87%), respectively (Table 3).

The results showed that the varieties used in the protein percent was significant (Table 2).The highest and lowest protein percent of Cultivars observed in Buko (23.36%) and oilseed radish (17.95%), respectively (Table 3. Fig 1).Kashani *et al*, (1986) declared percent protein 25% in Buko, and Hamdi *et al*, (1992) 24%.

Protein percent

Table 3. Mean comparisons of different traits at different crop rotation.

Treatment	Biological yield(kg)	Total dry matter (Kg)	Dry matter (%)	Plant height (cm)	Nitrogen (%)	protein (%)	Digestible protein (%)	Amount of total protein (Kg)	Digestible amount of protein (Kg)
Perko	69586a	7147.5a	10.48 b	41.7 b	3.36 abc	20.98 abc	16.04abc	1497.3 a	1143.7 a
Buko	67408a	5598.7 bc	8.36 b	43.5 b	3.82 a	23.36 a	18.724 a	1340.7 ab	1052.1 a
clover	38464b	4937.2 c	13.03 a	39.9 b	3.08 bc	19.28 bc	14.452 bc	945.9 b	707.8 b
combination of three plants(Ramtil, Phasilia, clover)	47950b	4866 c	10.19 b	58.15 a	3.58 ab	22.36 ab	17.314 ab	1086.2 ab	840.8 ab
oilseed radish	69164a	6664.4 ab	9.69 b	38.38 b	2.87 b	17.96 c	13.227 c	1202.8 ab	886.7 ab

In each partition, means followed by the same letters are not significantly different (Duncan`s multiple range test) P≤5% Conclusions.

Digestible Percent protein

The results showed that the varieties used in the digestible Percent protein was significant (Table 2).The highest and lowest digestible percent protein

of Cultivars observed in Buko (18.72%) and oilseed radish (13.27%), respectively (Table 3, Fig 1).

Amount of total protein

The results showed that the varieties used in the amount of total protein was significant (Table 2).The highest and lowest amount of total protein of cultivars observed in perko (1497.3 kg ha^{-1}) and clover (945.9kg ha^{-1})respectively (Table 3, Fig 2).

Table 4. Analysis of variance of different soil properties.

S.O.V	df	Mean-square(M.S)			
		Organic carbon before planting in soil	Organic carbon after planting in soil	Nitrogen in the soil before planting	Nitrogen in the soil after planting
Replication	3	0.037	0.036	0.0009	0.12
Treatment	4	0.052*	0.483**	0.0013*	0.175 *
CV	-	10.80	18.92	16.37	16.54

ns, * ,**: Non significant on 1 and 5 % levels of probability, respectively.

Table 5. The mean comparisons of different plant characteristics at different preceding crops.

Treatment	Organic carbon before planting in soil(%)	Organic carbon after planting in soil (%)	Nitrogen in the soil before planting(%)	Nitrogen in the soil after planting(%)
Perko	1.135 a	1.96 a	0.0975 a	0.122 ab
Buko	1.237 a	2.11 a	0.102 a	0.142 a
clover	1.147 a	1.68 ab	0.0975 a	0.13 a
combination (Ramtil, Phasilia, clover)	1.185 a	1.212 b	0.10 a	0.125 a
oilseed radish	0.937 b	1.605 ab	0.0775 b	0.092 b

Treatment with the same letters don't show significant differences.

Digestible amount of protein

The results showed that there was significant difference in the digestible amount of protein in the varieties used in this study (Table 2).The highest and lowest digestible amount of protein of cultivars observed in perko (1143.7 kg ha^{-1}) and clover (707.8kg ha^{-1})respectively (Table 3, Fig 2).In addition to the dry and wet performance levels in forage crops is important to note that forage quality, accordingly, was determined the amount of nitrogen and protein percent and digestible protein and total protein crop plantings. The *brassica* family of plants, and it was found the optimal conditions yield the quality was noticeably superior to the clover, and was produced, nearly 20 percent more protein. The results of these studies corresponded with studies Hamdi *et al*, (1992): Lvpashkvh, (1980): Kashani, (1982).

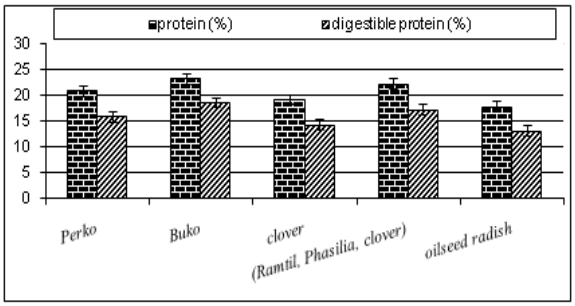

Fig. 1. Protein percent and digestible percent protein in varieties.

The results showed that the varieties were significant for the percentage of organic carbon before planting in soil (Table 4).All varieties of planting land (plots) except oilseed radish in a statistical levels from each other were not significantly different which

represents relative homogeneity of the field used for this research(Table 5, Fig 3)..

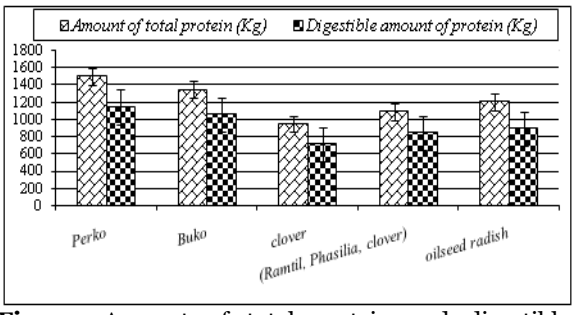

Fig. 2. Amount of total protein and digestible amount proteinin varieties.

Percentage of organic carbon after planting in soil

Forage produced on each plot, was chopped and mixed. After 15 days with complete the decay to determine of soil organic carbon percentage, data were analyzed. The results showed that the varieties were significant in the percentage of organic carbon after planting in soil (Table 4).Buko and Perko varieties by increasing the percentage of organic carbon at a rate of 0.872 and 0.827 compared to the other treatments were applied to further increase the amount of soil organic carbon. The least increase in the percentage of organic carbon was observed from the combined treatment (Ramtil, clover and Phasilia) at a rate of 0.027 (Table 5, Fig. 3).

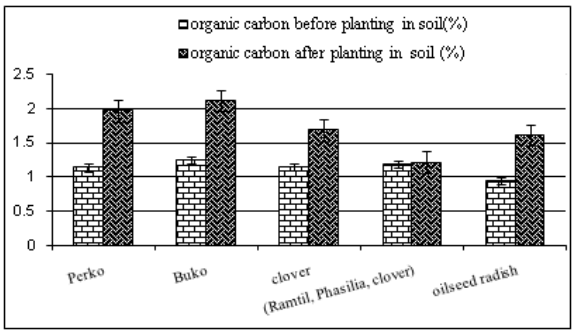

Fig. 3. Percentage of organic carbon before and after planting in soil using different varieties.

the amount of soil organic carbon. The least increase in the percentage of organic carbon was observed from the combined treatment (Ramtil, clover and Phasilia) at a rate of 0.027 (Table 5, Fig. 3).

Percentage of nitrogen before planting in soil

The results showed that the varieties were significant in the percentage of nitrogen before planting in soil(Table 4).All varieties of planting land (plots) except oilseed radish in a statistical levels from each other were not significantly different. Which represents relative homogeneity of the field is used for research(Table 5,).

Conclusion

The cultivars investigated here including; Perko, Buko, oilseed radish, Ramtil and phasilia were cultivated for the first time in Ilam province, so there were not any Information about their growth habits, climatic requirements, suitable time for planting, pests and diseases, and etc. According to the research findings the biological yield and dry matter of oilseed radish and perko varieties are better than other varieties and compared to clover forage varieties was good in the region. Based on the results we can recommend the cultivation of forage plants in *Brassica* genus in Ilam region, in terms of increased forage production and the quality of forage and soil improvement compared to the clover Finally among the cultivated varieties, Buko was superior compared to the other four cultivars.

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