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Full Length Research Paper

A study on the qualitative and quantitative traits of barley (*Hordeum vulgare L.*) and narbon vetch (*Vicia narbonensis L.*) in intercropping and sole cropping system under the interference and control of weeds in dry land farming conditions of Iran

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In order to investigate the effect of intercropping and sole cropping of barley and narbon vetch with weed control and interference conditions on their qualitative and quantitative traits, this experiment was conducted with 5 levels of intercropping (seed contribution): sole cropping of narbon vetch, 75:25 (narbon vetch : barley), 50:50, 25:75 and sole cropping of barley. Two levels of weed control and weed interference in row replacement series system in the form of factorial was designed with Randomized Complete Blocked Design (RCBD) in 3 replications in the College of Agriculture, Lorestan University, from 2006 - 2007. Results showed that the interaction of weed and the contribution of complementary components of intercropping has significant effect on crude protein (CP) and neutral detergent fibers (NDF) content in barley. Maximum CP and NDF were related to sole cropping of barley (infected by weeds), and maximum CP with minimum NDF were related to (narbon vetch: barley) 75:25 treatment, so that 31% of CP decreased in sole cropping of barley (infected by weeds) when compared with 75:25 combination. NDF percentage in sole cropping increased to 16.6%, therefore 25:75 (narbon vetch: barley) combination was better than the others. So, in order to get proper percentage of protein and digestibility of forage for livestock, 75:25 (infected by weeds) combination is better, especially the combination of 25:75 (infected by weeds), due to its high protein content. The highest and lowest dry forage production of barley were related to its sole cropping (a control which is equal to 3.75 t/ha) and 75:25 barley (infected by weeds that are equal to 1.59 t/ha), respectively.

Key words: Qualitative and quantitative, barley, narbon vetch, weed, dry land.

INTRODUCTION

Nutritive value is an important factor for forage crops and from early times, forage crop productions were related to nutritive value of these crops. Nutritive value of forage crops is related to its protein content, carbohydrates and mineral uptake (Karimi, 2000). In order to carry out a qualitative evaluation of forage crops, dry matter is not just the only important factor, but acid detergent lignin (ADL), crude protein (CP), neutral detergent fibers (NDF), lignin, digestibility and rate of energy are also important, in that they are generally variable on the basis of crop rotation, soil type and method of plow, nature and amount of organic and chemical fertilizers, method of pest and disease control, harvesting and seed separation, yield

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Abbreviations: ADL, Acid detergent lignin; **CP,** crude protein; **NDF,** neutral detergent fibers; **ADF,** acid detergent fiber; **BNF,** biological nitrogen fixation.

and biomass production (Baishya and Sharma, 1990; Singh et al., 1997). However, cereals like barley have high dry matter production, but their digistibility and CP are low for livestock; especially, late harvest results to reduction of their forage. So, substitution is profitable and sustainable. A case like intercropping is necessary (Panhwar, 2005). Narbon vetch forage at the beginning of flowering contains 16 to 17 percent of protein, 9.4 J/kg energy, 25.2% fiber, 6.2% minerals, 55.3% digestible materials and 10.1% digestible protein, showing that its forage can be used in feeding livestock, especially lambs.

Narbon vetch can make sustainable forage and money for a farmer in crop rotation or intercropping with barley, especially in regions where barley being the dominant crop in sole cropping made a pressure to the form and finally yielded a decrease (Feiz, 1974; Abd-El-Moneim and Zhibiaonan, 2002; Seymour et al., 2000). Haj-Ayed et al. (2000) believed that nutritive value and digestibility of organic matters of narbon vetch forage is as same as other legumes. Intercropping had an historical background and was a current system in dry land farming regions, especially in Mediterranean countries (Osman et al., 1983; Jones and Singh, 2000; Yau et al., 2001; Karadag and Buyukburc, 2003) where it is reported that intercropping had more forage yield than sole cropping. Also, dry forage quality of cereals is low, but in intercroppping with legumes, it becomes an important source of protein-carbohydrate. Byron et al. (2000) showed that intercropping of cereal-legume distributes qualitative and quantitative yield, so that biological and seed yield, as well as CP content and digestibility of nutrient materials in cereals of sole cropping, is lower than their intercropping with legumes or sole cropping of legumes (Vasilakoglou et al., 2005; Banik et al., 2000; Lithourgidis et al., 2006). It is reported that intercropping of cereal-legume may increase the percentage of seed CP, protein yield and length of optimum growth for cereal crops. Pisulewska et al. (2003) showed that increase of legume contribution in intercropping of legume-cereal increases dry matter and forage yield per area unit, but their protein nutritive value decreases significantly. Lithourgidis et al. (2006) reported that intercropping of vetch and oat with 65:35 combination led to more use of natural resources. So, the highest forage yield and protein content are obtained from this combination. Zaman et al. (2003) showed that NDF content of alfalfa: barley (wild oat) was more than the sole cropping of alfalfa and also the digestibility of alfalfa-barley decreased by weeds. Yasar and Buyukburc (2003) showed that the qualitative and quantitative traits of cereal's dry forage for feeding beef livestock is low, while intercropping of cereal-legume was the main source of protein and carbohydrate for livestock. Abd-El-Moneim (2000) reported that the seed of vetch had 33% protein and its amino acid composition is complete. Also, it has a high quality forage at the time of its shortage.

Beams et al. (2003) reported that harvest and physiological ripening of barley did not affect the forage chemical composition or nutritive value. Also, they showed that the method of drying (on field or artificial) did not affect digestibility of dry matter and keeps its nitrogen content. Assefa and Ledin (2004) showed that all intercropping system and protein content increased by the increase of vetch seed contribution. Kuusela et al. (2004) showed that legumes, in intercropping system, increased harvested CP content. Haj-Ayed et al. (2000) reported that the cause of CP increase in intercropping system is more than nitrogen (N) uptake per area unit. Assefa and Ledin (2004) showed that there are other important qualitative factors for forage crops like NDF and acid detergent fiber (ADF). So, one of the goals of this experiment is to evaluate the effect of weeds (in natural conditions or without use of chemical herbicides in their control and prevention from environmental pollution) on sole cropping and intercropping of barley and narbon vetch as source of protein in dry land farming regions (especially Lorestan province, Iran).

MATERIALS AND METHODS

This experiment was conducted in the cropping year from 2005 - 2006 at the research farm of College of Agriculture, University of Lorestan (located in Km 12 Khorramabad-Andimeshk road with longitude 46°21′, latitude 32°3′ and altitude 1117 m from sea level, with annual rainfall of 524 mm and annual average temperature of 17.7°C) with semiarid climate. Meteorological data of Lorestan province in years and results of physical-chemical analysis of soil of the research farm are shown in Tables 1and 2, respectively.

The experiment was designed as factorial 2 × 5 on the basis of RCBD in 3 replications. Each block had 10 plots with the dimensions 2.5 × 4 m. The length of each block (replicate) was 34 m and its width was 4 m. The distance between each block and each plots were 3 and 1 m, respectively. Each plot was divided into 8 rows for sole cropping (with a distance of 25 and planting depth of 10 cm) and intercropping on the basis of replacement series technique and seed contribution. Supplement components of this intercropping included 5 levels of combination (seed ratio), so that in sole cropping (100%) of narbon vetch 150 seeds/m^2 and in its combination of 75, 50 and 25%; 113, 75 and 38 seeds/m^2, respectively (plant spacing on the rows is 2.7, 3.5 and 10.5 cm, respectively) were used and in the sole cropping of barley (100%) 400 seeds/m^2 and in its combination of 75, 50 and 25%; 300, 200 and 100 seeds/m^2, respectively (plant spacing on the rows is 1, 1.3, 2 and 4 cm, respectively by using woody marker) were used. So, treatments obtained from the combination of weed plants and components of intercropping were as follows:

1. Weed at levels (control and infected): In this study, the competitive ability of sole cropping and intercropping of barley and narbon vetch was tested against a natural weed infestation (natural flora) and related to a series of forage plants traits.
2. Complementary components of the intercropping at 5 levels are as follow: a) 100% narbon vetch (sole cropping); b) 75:25 (narbon vetch: barley); c) 50:50; d) 25:75; e) 100% barley (sole cropping).

In this experiment line, 2561 of narbon vetch and Sara rood cultivar of barley were used. The first stage of weed control was done 20 days after planting, inside and between plots (control treatments). A total of 7 stages of sampling were done. The 1st sampling wasdone 45 days after planting by using a frame with dimensions 50 × 50 cm and omitting border effect (2 rows from sides and 15 cm from top and bottom of the second and third rows that included one row for both barley and narbon vetch in the intercropping and 2

Table 1. Meteorological data in years 1982 - 2006.

Month	Temp. (ºC)	Rainfall (mm)	Sunny (hours)	no. Frost-days
March	12.8	70.1	221	2.2
April	17.8	47.4	248.5	0
May	23.4	3.4	346.6	0
June	27.9	0.1	358.5	0
July	29.5	0.5	337.1	0
August	25	0.1	331.1	0
September	19.8	10.7	264.2	0.1
October	13.3	56.5	206.6	2.1
November	7.9	78	165.9	11
December	5.2	69	158	18
January	5.4	73.4	173.9	17.4
February	8.7	74	184	9.2
Annual mean	16.4	482.2	2770.5	61.2

Table 2. Results of physical-chemical analysis of soil of the research farm.

Factor	Rate	Unit
Acidity(PH)	7.77	
Ec	0.332	M mhos/cm
Inert material(lime)	15	%
Br	0.09	PPM
Cu	0.80	PPM
Zn	0.14	PPM
Mn	6.6	PPM
Fe	3.6	PPM
K	320	PPM
P	9.8	PPM
OC (organic carbon)	1.09	%
TN (total nitrogen)	0.103	%
Soil particles	Clay 44%- silt 42%- sand 14%	%
Soil texture	clay	

rows for both barley and narbon vetch in the sole cropping, along with weeds in each plot). Due to growth reduction in crops under experiment (winter), sampling was stopped and then before tillering, (fast growth of narbon vetch and weeds), the 2nd sampling was done. In this stage, sampling was done in width (in each plot) in the third and fourth row by removing 15 cm from the beginning of each row (border effect). Weed control was done every 2 weeks, by using hand weeding (natural flora of weeds at the experimental field contain mostly wild safflower, wild mustard, wild vetch, cow cockle, lamb's quarters and lesser bind weed and there was no narrow leaves weed). Seventh sampling was done by using a frame with the dimensions 1 × 1 m^2 and the sample was harvested from the middle of the four rows. Total forage of quadrate was harvested when barley seeds were in milky stage and narbon vetch was at complete flowering. After drying at 74°C for 24 h, samples were powdered by miller and then, the log of the powder of each sample (treatment) was collected for measuring CP and NDF by micro k-jeldhal and fibertic system, respectively.

Statistical analysis

Data of each traits was analyzed on the basis of factorial Randomized Complete Blocked Design (RCBD) by MSTAT-C software (version 1.42). Means comparison was done by Duncan's test at 1 and 5% levels. Also, correlation between traits were been calculated by MSTAT-C software, while Excel 2003 software was used to draw graphs.

RESULTS AND DISCUSSION

Percentage of CP and NDF of narbon vetch

Interaction of weeds and complementary components of intercropping was significant at 1% level (P = 0.001) (Tables 3 and 4). Results showed that the lowest mean

Table 3. Data analysis for quantitative and qualitative forage plants and weeds traits (mean squares of traits).

Source of variation	df	CP of narbon vetch (%)	NDF of narbon vetch (%)	CP of barley (%)	NDF of barley (%)	Total dry weight of weed	Total quantity of weed	Total biological yield
Replicate	2							
Weed	1	3.960**	0.456^{ns}	0.363*	11.285**	506.442**	2784.033**	2.085^{ns}
Components of intercropping	4	301.189**	561.774**	24.104**	2796.575**	2.548^{ns}	20.950*	2.612^{ns}
Weed × component of intercropping	4	0.399**	3.786**	0.381**	28.798**	2.548^{ns}	2.950*	1.196^{ns}
Error	18	0.054	0.394	0.051	0.844	0.946	5.815	4.721
Total	29							
C.V		1.83	3.63	6.33	2.38	8.77	10.61	10.72

^{ns}, Non significant; *, **significant at 5% level and significant at 1% level, respectively.

of protein content occurred at narbon vetch sole cropping (control of weeds to 14.8%) and the highest mean occured in (narbon bean : barley) 25:75 (infected by weeds combination equal to 16.9%) and the difference was 14%. So, it was concluded that the cause of this difference was weed stress and narbon vetch contribution in the reduction of intercropping system. On the other hand, weed acted as competitor and uptake moisture, light, nutrition, etc. So, they are the cause of drought stress and increase of protein content of narbon vetch. Therefore, by decrease of narbon vetch contribution in cereal-legume system, protein content increased. Increase of CP content had direct correlation with forage yield and the cause of forage production's increase is due to more stem growth than leaf growth. This is because the stem has lower protein content than the leaf. Consequently, forage production affected protein content. Also, the lowest dry forage production of narbon vetch obtained from 75:25 (narbon vetch: barley) combination, has the highest protein percentage observed in this combination. More so, there was no significant difference among sole cropping of narbon vetch, 75:25 and 50:50 with 15.43, 15.78 and 15.38% protein content, respectively (there was just a numerical difference between controlled and infected combinations). These results are in agreement with Tukel et al. (1997) results that showed protein reduction in legumes to be sole cropping. Yasar and Buyukburc (2003) showed that protein content of vetch decreased in over-average rainfall years and increased in drought years. Moisture reduction can be a cause of protein increase and weeds provided these conditions. The lowest mean of NDF percentage was related to 75:25 (infected by weeds combination equal to 20.4%) and the highest was related to 25:75 (infected combination equal to 23.10%) with a difference of 13% (Tables 3 and 4). 75:25 (control of weeds combination) showed more (2.9%) NDF content than the same combination but infected by weeds. Also, 75:25 (control combination to mean 21.1% of NDF) showed lower NDF content (9.4%) than the same combination but infected by weeds (that is, 75:25: infected by weed). Difference between narbon vetch sole cropping (control) and narbon vetch sole cropping (infected for NDF content) was 20.9%, and their NDF contents were 22.7 and 20.9%, respectively. So, it can be concluded that fiber content increased by an increase of narbon vetch contribution in control treatments, while fiber content decreased by an increase of narbon vetch contribution in infected treatments. Therefore, 75:25 (infected) combination got better minimum NDF, economically. In other words, weeds (species to the experiment field) did not have a considerable effect on increase of narbon vetch fiber content. So, the NDF decreased (8.6%) by an increase of narbon vetch density up to its sole cropping; infected by weeds. Also, weeds occupied spaces that were not used by crops on the basis of developing crop system resistant to weed invasion. Consequently, increase of narbon vetch density led to the use of more space (ground and air) and decreases the weed ability to compete with crop. Cardina et al. (1991) reported that increase of density is the best way to get more space. As a result, little space remained for weeds.

Percent of crude protein (CP) and neutral detergent fibers (NDF) of barley

Sole cropping of barley (infected by weeds) had the lowest protein content of 3.9% and (narbon vetch: barley) 75:25 (control of weeds) had the highest protein content of 5.13% with a difference of 31%. So, interaction of controlled and infected by weeds treatments with different contribution of seeds in intercropping system were significant at 1% level (P = 0.0000) (Tables 3 and 4). Therefore, on the basis of seed contribution, it was concluded that the highest protein percent was related to the lowest barley seed ratio and vice versa. On the other hand, 75:25 (infected by weeds) with 4.5% of protein had a significant difference at 1% level by the same treatment without weeds (the difference between them was 14%), in

Table 4. Mean comparisons in the interaction of different weed levels and mixed components ratio of narbon vetch and barley (Duncan 1 and 5%).

Treatment of weed control	CP of narbon vetch (%)	NDF of narbon vetch (%)	CP of barley (%)	NDF of barley (%)	Total dry Weight of weed	Total quantity of weed	Total biological Yield (t/hac)	Duncan level
Sole cropping of n. vetch(100%)	14.8^{e}	22.73^{a}	-	-				
75:25 (n.vetch: barley)	15.2^{de}	21.03^{c}	5.13^{a}	50.07^{ab}				
50:50	15.13^{de}	20.90^{c}	4.53^{bc}	47.97^{bc}				
25:75	16.27^{b}	21.13^{bc}	4.13^{bcd}	51.37^{a}				
Sole cropping of barley (100%)	-	-	4.53^{bc}	46.47^{cde}				
Treatments of infection by weeds								1%
Sole cropping of n. vetch(100%)	16.07^{bc}	20.93^{c}	-	-				
75:25(n.vetch: barley)	16.37^{b}	20.40^{c}	4.60^{abc}	44.83^{e}				
50:50	15.63^{cd}	22.60^{ab}	4.03^{cd}	45.27^{de}				
25:75	16.97^{a}	23.10^{a}	4.7^{ab}	47.37^{cd}				
Sole cropping of barley (100%)	-	-	3.9^{d}	52.27^{a}				
Treatment of weed control								
Sole cropping of n. vetch(100%)							7.76^{a}	
75:25 (n.vetch: barley)							9.98^{a}	
50:50							8.50^{a}	
25:75							10.19^{a}	
Sole cropping of barley(100%)							8.05^{a}	5%
Treatments of infection by weeds								
Sole cropping of narbon vetch(100%)					7.36^{b}	17.6^{b}	9.61^{a}	
75:25(n.vetch:barley)					6.78^{b}	14.3^{b}	10.08^{a}	
50:50					9.44^{a}	22.6^{a}	9.54^{a}	
25:75					7.76^{b}	18.3^{b}	10.08^{a}	
Sole cropping of barley(100%)					9.72^{a}	23.3^{a}	8.04^{a}	

Similar letters show that there is no significant difference.

which this protein reduction was related to weed presence. Also, protein percent of barley sole cropping (control of weeds) was 4.53%, which had 16% lower protein than the same treatment with weeds and there was a significant difference at 1% level. Yasar and Buyukburc (2003) reported that protein reduction in sole cropping of barley (9.77%) and its increase in intercropping of barley-forage pea happened because of the increase of pea ratio in that intercropping system. Also, Karadag and Buyukburc (2003) reported that the lowest protein content was related to sole cropping of barley, which agreed with the present results. So, in order to get high protein content of barley, 75:25 (control of weeds) combination is suitable.

Vasilakoglou et al. (2005), Banik et al. (2006) and Lithourgidis et al. (2006) reported that vetch had a positive effect in intercropping system with cereals and also demonstrated the role of vetch in the control of weeds, decrease of cereal lodging and yield stability. So, it has a positive role in the increase of CP and protein yield. Protein percent difference between sole cropping and intercropping of barley was 15.5%. This was confirmed by Yasar and Buyukburc (2003) that showed that quantitative and qualitative of cereal's dry forage is low but improved by cereal-legume intercropping system. The highest mean fibers was related to sole cropping of barley (infected by weeds) treatment (52.27%) and the lowest to (narbon bean: barley) 75:25 (infected by weeds) (44.83%) treatment and their difference was 16.6%, which shows their different digestibility (Tables 3 and 4). NDF of barley sole cropping (control of weeds) was 46.47% which showed 12.5% difference in fiber content or digestibility. Fiber content of 75:25 (treatment) was 50%, that is, 11.5% more than the same seed contribution with weeds (44.8%). So, intra specific competition of barley for getting source of nutrients (especially moisture) with weeds was more than the negative effects of weeds at weed control system for this crop. In other words, intra specific competition was more than weeds competition. So, NDF of all seed ratio increased by decrease of narbon vetch contribution at infected by weeds treatments. Also, rate of N fixation and vegetative growth of barley increased by increase of narbon vetch contribution and then, fiber content decreased because of N increase and shading of weeds. The reason for the increase of fiber content in combinations with low contribution of barley is at first barley lodging (low density of barley and high density of narbon vetch at the combinations). This is because narbon vetch twisted around barley stem. The second reason is the increase of N fixation of narbon vetch and then, the occurence of barley lodging, while nutrient translocation for optimum growth did not happen. Also, nitrogen fixation increased weed stress and fiber content increased at these combinations.

Therefore, fiber production increased by increase of barley contribution in intercropping system. Thus, the digestibility of barley in its sole cropping (infected by weeds) combination was lower than other combinations and digestibility of 75:25 (infected) was higher than the others. Lithourgidis et al. (2006) reported that NDF content of oat-vetch intercropping and triticale-vetch intercropping were different on the basis of their different seed ratios and type of intercropping components. Also, they reported that this value can be changed by different densities and species.

Sum of the biological yield

There were no significant differences among means of main effects (weed control and infected by weeds and different levels of intercropping) at 5% level. Also, interactions of weed control and infected by weed levels and different combinations were not significant. On the basis of analysis of variance (ANOVA) and mean comparison (Duncan's test) at 5% level ($P > 0.05$), the means of the lowest biological yield was related to sole cropping of narbon vetch (control equal to 7.76 t/ha), followed by sole cropping of narbon vetch (infection equal to 8.04 t/ha) and the highest sum of the biological yield was related to 25:75 (control equal to 10.19 t/ha). Difference between the highest and the lowest sum of the biological yield was 26.7% (Tables 3 and 4). Also, biological yield of narbon vetch sole cropping (infected combination equal to 9.61 t/ha) and its difference with sole cropping (control) was 23.8%. This difference for barley sole cropping was contrasting such that the biological yield of barley sole cropping (control) was 8.05 t/ha in comparison to sole cropping (infected) that had 12% difference. As a result, the negative effect of weeds was shown on different growth stages of barley. So, the biological yield of intercropping system was affected by the seed ratio of two components of intercropping that increased by a decrease of narbon vetch seed contribution. By the way, cause of this variation was due to change of inter-specific and intra-specific competition of two components of intercropping system, so that barley in 25:75 (control) combination acted as an anchor for narbon vetch because of its optimum density. On the other hand, intra specific competition of narbon vetch decreased by using the light that was placed on the top of the canopy at the best situation for growing. According to the results of this experiment, in order to increase the protein content and decrease fiber (digestibility) at the considerable intercropping system, it was concluded that 75:25 (infected) combination had the highest protein content after 25:75 (infected) combination. Although, 25:75 (narbon vetch: barley) - infected combination, had 3.7% lower protein content than 75:25 (narbon vetch: barley) - infected, the NDF of 75:25 (narbon vetch: barley)-infected combination was 13.2% lower than that of 75:25 (narbon vetch: barley) - infected. So, for the fact that the qualitative balance of forage combinations and the control of weeds were not necessary, 25:75 (narbon vetch: barley) - infected

was better than others, especially 75:25 (narbon vetch: barley) - infected combination.

The effect of intercropping complementary components on weeds

The lowest dry weight of weeds (6.78 gr/m^2) belonged to 75:25 combination and the highest mean of weeds' dry weight (9.72 g/m^2) belonged to sole cropping of barley. Interaction of weeds and different levels of seed treatments (in total dry weight of weeds) were not significant ($P > 0.05$) (Tables 3 and 4). Difference in the biomass of weeds between these two combination was 43.3%. Thus, it resulted that the increase of planting density (seed ratio of mixed components) in intercropping (especially increase of vetch share in intercropping) caused the decrease of total dry weight of weeds even to the reduction of their quantity. So, interaction infected level and mixed complementary components (seed ratios) had a significant difference at 5% level. Mixed complementary component 75:25 had the lowest weed quantity equal to 14.3 no/m^2 and the highest weed quantity, related to sole cropping of barley component, equal to 23.3 no/m^2. In this infection level (sole cropping of barley to weed quantity equal to 23.3 no/m^2), weed quantity (63%) was more than 75:25 combination. In sole cropping of vetch, weed quantity was 17.6 no/m^2, that is, in comparison to sole cropping of barley, it showed a reduction of 32.4%. There is a probability that the high seed ratio of vetch in 75:25 combination caused high biological nitrogen fixation (BNF), more growth of barley and increased light absorption. Thus, this combination control of weeds (especially weed quantity) was more effective than other seed ratios. Olasantan et al. (2003) reported that intercropping of corn-cassava: weed with nitrogen fertilizer had the most light absorption and reduction weed quantity showed in high nitrogen treatments. Thus, the result of this experiment shows that more density of vetch in 75:25 combination had been an effective component in the rapid growth of weeds, which prevented their germination and plantlet transpiration from soil. This resulted to a short critical period of germination for weeds growth and a final negative effect on the total quantity of weeds in the unit area. Thus, narbon vetch has a higher domination in comparison to barley in the control of weeds.

On the basis of the present results, it is suggested that due to a likely annual research on forage produce, soil conservation and exploitation from natural resources, by imitation from nature, experiment should be carried out and implemented in different regions with plants and different seed ratios.

REFERENCES

Abd-El-Moneim AM, Zhibiaonan B (2002). Two vetches hold promices in drought-prone areas. Available online at http:// www. Icarda. Cigar. Org. 17: 1-2.

Abd-El-Moneim AM, Ziyadullaev Z, Zhanysbayev B, Korahkashvili A, Amirov L (2000). Vetches and chickling in central asia and the Caucasus. Available online at http:// www. Icarda. Cigar. Org. pp. 1-3.

Assefa G, Ledin I (2004). Effect of variety, soil type and fertilizer on the establishment, growth, forage yield, qulity and voluntary intake by cattle of oats and vetches cultivated in purestand and mixtures. Anim. Feed Sci. Technol. 92: 95-111.

Baishya A, Sharma GL (1990). Energy budgeting of rice-wheat cropping systems. Indian J. Agron. 35(12): 167-177.

Banik KP, Sasmat T, Ghosal PK, Bagchi D (2000). Evaluation of mustard (*Brassica campesteris* var. Toria) and legume intercropping under 1:1 and 2:1 Row-Replacement series systems. J. Agron-Crop Sci. 185: 9-14.

Banik P, Midya A, Sarkar BK, GHose SS (2006). Weath and chickpea intercropping systems in an additive series experiment. Adventages and weed smothering. Eur. J. Agron. 24: 325-332.

Beams RM, Tait RM, Pringle DB, Owen BD (2003). The nutritive value of barley for monogasteric animals and for ruminants as affected by artificial drying and alkali and anaerobic storage. Field Crop Res. 15: 285-299.

Byron S, Kenneth J, Ronald G, Edward CB (2000). Binary legume-Grass mixture improve forage yield, quality, and seasonal distribution. Agron. J. 92: 24-29.

Cardina J, Regnier E, Harrison K (1991). Long-term tillage effects on seedbank in three ohisoils. Weed Sci. 39: 186-194.

Feiz AM (1974). Agronomy of forage crops and grazing land establishment: Rezaee agricultural College. pp. 137-138.

Haj-Ayed M, Gonzalez J, Caballero R, Alvir MR (2000). Nutritive value of on-farm common vetch-oat hays. II. Ruminal degradation of dry matter and crude protein. Ann. Zootech. 49: 391-398.

Jones MJ, Singh M (2000). Long-Term yield patterns in barley-based cropping systems in northern Syria. The role feed legumes. J. Agric. Sci. Camb. 135: 223-236.

Karadag Y, Buyukburc U (2003). Effects of seed rates of forage production, seed yield and hay quality of annual legume-barley mixtures. 27: 169-174.

Karimi H (2000). Agronomy and plant breeding of forage crops. Tehran university press. pp. 13-15.

Kuusela E, Khalili H, Nykanen-Kurki P (2004). Fertilization, seed mixtures and supplementary feeding for annual legume-grass-cereal past users in organic milk production systems. Livest. Prod. Sci. 85: 113-127.

Lithourgidis AS, Vasilakoglou IB, Dhima KV, Dordas CA, Yiakoulaki MD (2006). Forage yield and quality of common vetch mixtures with oat and triticale in two seeding ratios. Field Crop Res. 99: 106-113.

Olasantan FO, Lucas EO, Ezumah HC (2003). Effects of intercropping and fertilizer application on weed control and performance of cassava and maize. Field Crops Res. 39: 63-69.

Osman AE, Nersoyan N, Somaroo BH (1983). Effects of phosphate, seed rate, seed ratio and harvesting stage on yield and quality of forage legume cereal mixtures. Forage Res. 9: 127-135.

Panhwar F (2005). The production of barley (*H. vulgare* Linn) in sindh pakistan. Digitalverlag gmbh, germany. 157: 1-5.

Pisulewska E, Hanczowski P, Pisulewski P (2003). Yield, composition and nutritive value of leaf protein concentrates from mixed forages and legumes. Crop Prot. 27: 117-125.

Seymour M, Siddique K, Jones R, Riethmuller G (2000). Narbone Bean, a multi-purpose grain legume for the low rainfall cropping areas. Agriculturer Western Australia. Farmnote, p. 23.

Singh MK, Pal SK, Thakur R, Verma UN (1997). Energy input-output relationship of cropping systems. Indian. J. Agric. Sci. 67(6): 262-264.

Tukel T, Hasar E, Hatipoglu R (1997). Effect of mixtures rates and cutting dates on the forage yield and quality of vetch-triticale mixtures and their seed yields under lowland conditions of cukurova. XV III international grassland congress. June 8-12. Canada. pp. 25-26.

Vasilakoglou IB, Lithourgidis AS, Dhima KV (2005). Assessing common vetch-cereal intercrops suppression of wild oat. Proceeding of 13th

international symposium. Session 5. European weed Research Society. Bari. Italy. pp. 287-305.
Yasar K, Buyukburc U (2003). Effects of seed rates on forage production, seed yield and hay quality of annual legume-barley mixtures. Turk J. Agric. 27: 169-174.
Yau SK, Hajhassan S, Nassar A, Maacaroun R (2001). Grain legumes in rotation with barley: A sustainable cropping system for nourthern Bekaa, Lebanon. In proceedings of fourth European conference on grain legumes. July 8-12. Cracow, poland. Eur. J. Agron. p. 344.
Zaman MS, Moyer JR, Boswall AL, Mir Z (2003). Nutritional quality and yield of seeding alfalfa established with a barley companion crop and weeds. Anim. Feed Sci. Technol. 103: 163-169.