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Exploring the Possibility of Discharge of Nitrogen from the Lower Part of the Soil by two Between-crops Plant of Perko and Buko in order to better Use and Prevent the Waste of Nitrogen

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Abstract

Since the nitrogen is one of the essential elements of plant with high mobility and tremendous waste, some cover crops with improved root system probably can prevent leaching of this element. This study was done in Agricultural Research Station of Islamic Azad University of Karaj located in Mahdasht area during the crop year 2013-2014. This study was done by using factorial experiment in a randomized complete block design with two cultivars of Brassica family of Perko and Buko, 3 levels of nitrogen (N0, N150, N300) Kg per ha, from urea source (due to nitrogen use efficiency in Karaj) at two different depth of 0-30 and 30-60 cm of soil. The research results showed that the triple interaction of in-depth plant at nitrogen on root fresh weight, root dry weight, the percentage of nitrogen in depth of 30 cm, 60 cm depth of soil nitrogen, at probability level of 1% and the percentage of organic carbon ($P < 0.05$) among the studied plants is significant. The comparisons showed that Buko at the highest amount of applied nitrogen in the soil (300 kg N ha) left less nitrogen in the soil. The lowest amount of nitrogen leaching was for a depth of 30 cm and at 150 kg of nitrogen per hectare which belonged to Perko. By using high levels of nitrogen in the soil the waste and leaching of this element was tremendous. Therefore, Perko root fresh weight and root dry weight at 150 kg nitrogen per hectare were the highest at 30 cm depth of soil. Control plants had low root dry weight yield and aerial dry weight yield. Buko root length at a 60 cm depth of soil was higher than Perko so that at this depth of soil Buko was capable than Perko in preventing the nitrogen waste. Buko at high levels of nitrogen had higher nitrogen percentage in root and aerial organ. The protein amount of aerial organ increased with enhancement of nitrogen absorption to plant organs. Buko had more protein than Perko. Buko total dry weight was more than Perko.

Keywords: brassica family cover crops, nitrogen uptake, leaching, volatilization, soil depth, appropriate use of nitrogen

Introduction

Nitrogen is one of the key and effective elements for plants and soil fertility. Fertility and dynamics of many agriculture and forestry ecosystems is limited by the available nitrogen rate because the soil available nitrogen in agricultural ecosystems and consequently nitrate and ammonium uptake changes by plants and soil microbes loss through leaching, denitrification and volatilization. Reducing the intensity of leaching in humid ecosystems and in areas under heavy irrigation through maintaining it in soil microbial biomass is valuable environmental strategy that has been considered in recent years (Mafongoga et al., 2000). In addition to chemical and biochemical properties of plant residues that have a big impact on the dynamics of nitrogen in the soil, environmental factors such as temperature, humidity and the type of soil are effective on the process (Tate, 2000). The fertilizer use rate has major impact on the movement of nitrogen and its fate in the soil (Galloway et al., 2004; Heumann et al., 2002).

The nitrogen that is not absorbed by the plants is lost through denitrification, runoff, and leaching. Such waste will increase worrying about water pollution and greenhouse gas emissions (Blay Lock and Dawbonko, 2005). Todays, the role of cover crops in improving soil structure and quality and preventing soil erosion and the growth of weeds, pests and diseases is determined well. But what is superior over the other benefits in these plants refers to the enhancement of soil organic matter and consequently less consumption of chemical fertilizers and preventing environmental pollution (Hashemi et al., 2010). Between crop plants of brassica family, Preko hybrid is resulted from the confluence between Brassica napus L.var.napus and Brassica rapa subsp. Chinensis (L.) and Buko plant is a new amphiploid which is the result of confluence between tetraploid winter rapeseed (Brassica napus L. var napus) and Chinese cabbage and forage turnips which in many ways is superior than its parents. These hybrids due to being palatable are used as animal nutrition and also due to the rapid growth of root and organs and making quick cover on the soil surface and high performance of its aerial organs can be used in stable and organic farms as cover crop and green manure (Mihailovic et al., 2008). Another interesting capability of cover plants refers to fixing the moving nitrogen so that convert nitrogen to nitrate nitrogen and then to protein inside the plant and in this way they timely prevent the waste of nitrogen through leaching or denitrification (Pink et al., 1948). In addition, by cultivation of these plants the conserve and save of nitrogen or soil nitrogen deficiency is improved (Cambardella and Elliott, 1992). Therefore, the greatest attention of researchers to cover crops is due to the impact of these plants on soil nitrogen management. Because on the other side often the greatest constraint in the production of different crops is also affected by nitrogen (Thiessem-Martens et al., 2005). Accordingly, this study aimed to evaluate the ability of between-crop plants of brassica family (Perko and Buko) in the use of nitrogen and comparing them with each other to absorb nitrogen from the lower part of the soil and also checking the crop nitrogen uptake by plants brassica family (Perko and Buko) from two different soil depth and investigating the relationship between the root system of the mentioned plants and nitrogen absorption and enhancement of nitrogen efficiency and preventing leaching and comparing these figures with each other to efficient use of nitrogen and less consumption of chemical fertilizers due to their disadvantages and moving in the direction of sustainable agriculture.

Materials and Methods

This study was done in Agricultural Research Station of Islamic Azad University of Karaj located in Mahdasht area during the crop year 2013-2014. The experiment implementation location is placed at geographical coordinates of 35 degrees and 55 degrees of geographical latitude and 50 degrees 54 minutes geographical longitude with altitude of 1313 meters above sea level with an average rainfall of 250 mm per year and the annual temperature of 16-14 ° C temperature and annual evaporation rate of about 791.8 mm. Before conducting the experiment the soil composite samples were prepared from zero to 30 and 30 to 60 cm deep and then the physical and chemical properties of the soil were determined in laboratory (Table 1).

This study was done by using factorial experiment in a randomized complete block design with four replications of two cultivars of Brassica family with names of Perko, which was obtained by confluence of tetraploid winter rapeseed plants (Brassica n napus var napus .L) with Chinese cabbage (Brassica campestris L . var. sensulato), Buko new amphiploid plant derived from crosses between tetraploid winter rapeseed (var napus.L Brassica napus) with Chinese cabbage (Brassica campestris L. var. sensulato) and turnip (Brassica campestris L. var. rapa) as well as 3 nitrogen levels (N0, N150, N300) Kg per hectare, utilized urea source (due to nitrogen use efficiency in

Karaj) at two depths of 0-30 and 60-30 cm soil. Test in Cretes with dimensions of 2 to 3 square meters with one and a half meters distance between each crete and 3.5 meters distance between each repetition was conducted in the form of farm, so that the cultivation of pre-planting plants was done in the third mid of March. Thus, according to the statistical map design in some intended plots all cultivated soil of plots was moved 60cm and in some other 30 cm respectively and then the amounts of nitrogen in the considered depth was replaced in the soil and again all soil of each plot after replacement of fertilizer in the suitable depth of soil was returned into each plot. During the growth period once every 10 days the margins of sampling was removed to determine the total biomass (Kg/ha) based on the sigmoid equation three parameter $DM = y0 + a * t + b * x ^ 2$ and $DM = y0 + a * t + b * y$ for two depths of 30 and 60 cm of soil respectively DM: total biomass (Kg/ha) a: width of origin, t: interval sampling and b the slope of the curve.

Table 1. Physical and chemical properties of the soil

Total nitrogen%	Silt%	Clay%	Sand%	Organic carbon%	pH	Moisture saturation%	EC ds/m	soil texture	Soil depth cm
0.08	18	25	57	0.68	7.8	32	2.83	Sandy Clay	0-30
0.06	15	25	60	0.53	7.6	32	3.7	Sandy Clay	30-60

Then, 60 days after the cultivation of between crop plants, the plants were returned to the soil surface and study characteristics were measured. In order to measure the percentage of soil nitrogen from the depth of 30 cm and then from 60 cm depth of soil were sampled separately and then the percentage of soil nitrogen was calculated by Kjeldahl method. Also, Kjeldahl method was used to measure the percentage of nitrogen of aerial organ and root nitrogen percentage (humid oxidation) respectively (Bremner &Mulvaney 1982). Walkley-Black method was used to measure organic carbon and to measure the amount of protein after obtaining the nitrogen percentage the nitrogen percentage formula at 6.25 was used. The percentage of dry matter of plants was measured by ratio of dry matter yield to the wet matter yield multiplied by 100. To measure the length of root, plicae pipes were placed in the ground and a plant was planted in each tube and then pipe plicaes were removed from the ground. Finally, without damaging the roots, after removing the air from the root, size root length was measured in millimeters with a special cache. SAS software was used to analyze the data (Maddah Yazdi, 2008). As well as to compare the treatments the LSD test was used at probability level of 5%.

Results and discussion

Results of variance analysis are provided in Tables 2, 3 and 4. Observing the statistical results showed that the fresh weight of root, root dry weight, nitrogen percentage of 30 cm soil depth, 60 cm depth of soil nitrogen percentage, there is a significant difference among studied plants at different levels of nitrogen in both 30 and 60 cm soil depth at probability level of 1% and the percentage of organic carbon at probability level of 5%. Binary interactions of other traits except the root length also were significant at probability level of 5% and 1%.

Table 2: ANOVA results for effect of the amount and depth of replacement of nitrogen **(LSD= 0.05)**

		Sum of Square			
Source of Variation	Df	Total dry matter (Total biomass) (Kg/ha)	Percent of dry weight	Shoot nitrogen percent	Protein percent of aerial organs
Replication	3	98387.66^{ns}	0.000076^{ns}	0.10960^{ns}	4.281^{ns}
Plant (A)	1	9621968.43**	0.00052**	0.47401**	18.51**
Depth (B)	1	38646.75^{ns}	0.00415**	0.15300**	5.97**
A×B	1	1070301.87**	0.00845**	0.1150*	4.49*
Nitrogen (C)	2	49875936.32**	0.01109**	18.50**	722.76**
A×C	2	7074941.12**	0.00186**	0.937**	36.61**
B×C	2	1943469.36**	0.000063^{ns}	0.5300**	20.70**
A×B×C	2	246124.08^{ns}	0.000073^{ns}	0.0893^{ns}	3.48^{ns}
Error	33	1661565.10	0.00054	0.5281	20.63
Coefficient of variance		6.28	2.68	4.71	4.71

ns,*, and **, respectively indicate lack of significance , significant difference at the level of 5% and significant difference in the level of 1% .

Table 3: ANOVA results for effect of the amount and depth of replacement of nitrogen(LSD= 0.05)

				Sum of Square		
Source of Variation	Df	Root dry weight(g per plant)	Root nitrogen percent	Root length	O.C%	Root fresh weight (g per plant)
Replication	3	1.26^{ns}	0.4886^{ns}	92.89**	0.00095000^{ns}	8041.66^{ns}
Plant (A)	1	13379.70**	7.74**	63.02**	0.01920000**	117018.75**
Depth (B)	1	97.44**	0.3072ns	38.52*	3.75086667**	92752.08**
A×B	1	2.19^{ns}	0.9747**	6.02^{ns}	0.01763333**	44408.33**
Nitrogen (C)	2	610.71**	2.312**	1024.29**	0.00155000^{ns}	2559457.29**
A×C	2	261.79**	0.028^{ns}	31.79^{ns}	0.57203333**	54365.62**
B×C	2	387.64**	1.064*	0.541^{ns}	0.03921667**	88944.79**
A×B×C	2	441.03**	0.0675^{ns}	0.541^{ns}	0.00406667*	42519.79**
Error	33	27.44	3.63	204.85	0.01765	65583.33
Coefficient of variance		2.97	16.37	3.62	2.25	7.25

ns,*, and **, respectively indicates lack of significance, significant difference at the level of 5% and significant difference in the level of 1%

By comparing and measuring nitrogen percent at soil depth of 30 cm, it was observed that the maximum amount of nitrogen remains in the soil was for quantities of 150 kilograms of nitrogen per hectare which belonged to Perko (1268kg/mg). In other words, the lowest waste and leaching of nitrogen for Perko was in these values. It seems that the amount of nitrogen moving downwards compared with 300 kg nitrogen in 30 cm soil depth is lowered. After that, the most of the nitrogen remains in the soil was for the Buko cover crop in the same amounts of nitrogen (1151 kg/mg). We also observed that by increasing the amount of nitrogen fertilizer the move towards lower part of soil was increased.

Table 4: ANOVA results for effect of the amount of nitrogen in soil depth(LSD= 0.05)

		Sum of Square		
Source of Variation	df	The amount of soil nitrogen at 30 cm depth(mg/kg)	The amount of soil nitrogen at 60 cm depth (mg/kg)	total nitrogen percent in two soil depths of 30 and 60 cm(%)
Replication	3	0.0000025^{ns}	217.132^{ns}	105.38**
Plant (A)	1	0.000657**	12523.03**	25307.88**
Depth (B)	1	0.144595**	31602.34**	171130.05**
A×B	1	0.004561**	93968.41**	333545.03**
Nitrogen (C)	2	0.008446**	519968.06**	113053.34**
A×C	2	0.002406**	300029.73**	39078.36**
B×C	2	0.004152**	199066.83**	4439.14**
A×B×C	2	0.001468**	114883.80**	130700.80**
Error	33	0.0000084	590.30	703.35
C.V		0.34	0.44	0.46

ns,*, and **, respectively indicates lack of significance , significant difference at the level of 5% and significant difference in the level of 1%

Table 5: Comparing the mean of the amount of nitrogen in two soil depths of 30 and 60 cm

The amount of soil nitrogen at 30 cm depth (mg/kg)	The amount of soil nitrogen at 60 cm depth (mg/kg)	total nitrogen percent in two soil depths of 30 and 60 cm(%)			
			Soil depth(cm)	Nitrogen	Plant
771.6i	1143b	0.077%i	30	0	Perko
817.7h	817.7j	0.081%h	60		
1268a	1321a	0.126%a	30	150	
907.5f	907.5b	0.090%f	60		
979.1e	992.8e	0.097%e	30	300	
873.8g	873.8i	0.087%h	60		
1053c	926.9g	0.105%c	30	0	Buko
1005d	1005d	0.100%d	60		
1151b	921.9g	0.115%b	30	150	
1055c	1055c	0.105%c	60		
646.5j	970.7f	0.064%j	30	300	
901.9f	901.9h	0.090%f	60		

The treatments with a common letter have no significantly different(P>0.05).

The lowest amount of residual nitrogen in the soil was for 300 kg N per hectare in the soil depth of 30 cm that belonged to Buko cover crop so that the amount was lower than the control soil values (646.5kg/mg) (Table 5). It seems that with increasing fertilizer rate from 150 to 300 kg N per hectare sublimation or due to the more mobility of nitrogen leaching of the element was increased. Some researchers have announced that an increase in nitrogen leaching is related to the enhancement of application of fertilizer (Fang et al., 2006). The research results of Galloway (2004) and Heumann et al. (2002) also showed that the amount of fertilizer consumption has a large impact on the movement of nitrogen and its fate in the soil. Also, by measuring all nitrogen percent of the 60 cm soil depth it was found that the lowest amount of nitrogen remains in the soil after 60 cm soil depth of control was for the amount of 300 kg N per hectare in the 60 cm soil depth in which the Buko cover crop was planted (873.8kg/mg). The results were consistent with the research of Sadej and Przek was (2007). The researchers found that fertilizer has a significant effect on increasing the concentration of different forms of nitrogen in the soil profile. So that most of the nitrogen concentration enhancement occurred in the upper layers of the soil profile and soil nitrogen amount was decreased with depth increasing.

Table 6: Comparing the mean of the cover crop species at different levels of nitrogen at depth

Root Fresh weight (g per plant)	Root dry weight(g per plant)	O.C%			
			Soil depth(cm)	Nitrogen	Plant
140.1 e	34.94e	0.68h	30	0	Perko
182.7d	48.13c	0.53j	60		
261.6a	61.16a	1.31c	30	150	
193.6c	47.94c	1.0g	60		
186.9d	41.74d	1.39a	30	300	
205.2b	49.53b	1.07f	60		
55.26i	10.12i	0.71h	30	0	Buko
56.17i	11.24i	0.59i	60		
82.82h	13.18h	1.33cb	30	150	
86.88h	16.54g	1.11e	60		
92.87g	13.58h	1.36b	30	300	
117.6f	18.93f	1.16d	60		

The treatments with a common letter have no significant difference ($P>0.05$).

It seems that quick growth of root and enhancement of the root length in this soil depth lead to greater access to the soil nitrogen rate. Because Buko compared to the Perko had more root length at 60 cm soil depth, but the root length of Perko at two soil depth of 30 and 60 cm was the same. After considering and measuring the root nitrogen percent it was observed that the highest percentage of root nitrogen of Buko was in the soil depth of 60 cm (2.65 mg nitrogen in per 100 g root). Also, the most root nitrogen uptake was obtained at 60 cm soil depth with the highest nitrogen applications rate (300 KgN / ha) (Figure 1) .

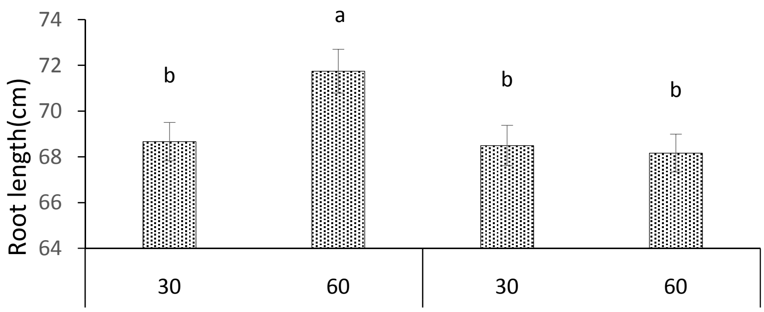

Figure 1: **Comparison of the mean of root length at depth for both Buko and Perko plant**

After considering the nitrogen uptake percent of aerial organs it was also observed that the highest nitrogen percentage of aerial organ belonged to Buko cover crop at the highest amount of nitrogen application (300 kg/ha) (Table 8). The nitrogen percentage of aerial organ of Buko in both soil depth was higher than Perko. Therefore, it seems that through the nitrogen uptake by the roots of the Buko in the highest amount of applied nitrogen in the soil, its transfer to aerial organs is increased (3.78%) and consequently, it is likely that the nitrogen leaching at a 60 cm soil depth is prevented. Although, nitrogen uptake by aerial organs of Buko was more than Perko, but, in general, both plants at 60 cm soil depth compared to 30 cm soil depth in the highest amount of applied nitrogen (300 kg/ha) had higher nitrogen uptake to aerial organs. In addition, whatever more nitrogen to be absorbed by plant organs, the amount of protein of aerial organs is also increased (Reiad et al., 1995). So that the highest amount of protein for Buko was obtained in the highest amount of applied nitrogen (300 kg) (23.62%). Perko cover crop protein rate with applying 300 kg N per ha was less than Buko and was equal to 19.95% (Lupashku, 1980) because it had lower nitrogen uptake percent compared to the Buko (3.19%). It was also observed that the amount of protein in the control plants was the lowest (12.12%) (Table 8).

Table 7: Comparing the mean of different levels of nitrogen at depth

(Kg/ha) Total biomass	Root nitrogen percent	Shoot nitrogen percent	protein percent of aerial organs		
				Depth(cm)	Nitrogen(Kg/ha)
2440.1d	1.68c	1.99%d	12.46%d	30	0
2062.7e	1.74c	1.95%d	12.19%d	60	0
3438.5c	2.25ab	2.61%c	16.32%c	30	150
4311.1b	2.10bc	2.58%c	16.14%c	60	150
4755a	1.90c	3.28%b	20.50%b	30	300
4710a	2.46a	3.69%a	23.07%a	60	300

The treatments with a common letter have no significant difference (P>0.05).

The amount of nitrogen left in the soil after calculating showed that the amount of 150 kg of nitrogen per hectare was replaced at a depth of 60 cm and then Buko cover crop was planted. The amount of residual nitrogen in the soil was equal to the amount of residual nitrogen percent in the soil depth of 60 cm with the highest rate of nitrogen application (300 kg N ha) in which the cover crop of Buko was cultivated. As mentioned above, it seems that with increasing the amount of fertilizer from 150 to 300 kg N ha sublimation or due to more mobility of nitrogen the leaching of this element is increased and here the application of 150 kg nitrogen will have higher priority to higher levels of applied nitrogen for cover plants because the performance of 150 kg N ha was equal to the performance of 300 kg N ha (Table 5). In other words, by the use of higher levels of nitrogen in the soil the leaching and waste of this element was increased. It seems that in lower amounts of nitrogen the nitrogen leaching and mobility is less than the use of higher levels of nitrogen and here probably due to the rapid growth of roots and soil properties the root access to nitrogen was higher and then nitrogen is transferred to aerial organs. The research results of Novokova and Nagel (2009) in the nitrate movement in a clay loam soil with low hydraulic conductivity under the influence of different amounts of nitrogen fertilizer and irrigation water showed that the nitrate concentration decreased with increasing soil depth and plants' nitrate uptake speed was more than its movement to lower layers of soil and its waste. In general, based on studies of Malhi et al (2001) the fate of nitrogen in plant-soil set depends on several factors including plant, climatic, physical and chemical properties of the soil, the rate of applied fertilizer and irrigation management

Table 8: Comparing the mean of the cover crop species at different levels of nitrogen

)kg/ha(Total biomass	Shoot nitrogen percent	protein percent of aerial organs		
			Nitrogen(Kg/ha)	Plant
2008.7e	%1.94d	%12.12d	0	Perko
3620c	2.62%c	%16.41c	150	
3746.9bc	3.19%b	%19.95b	300	
2494.1d	2%d	%12.53d	0	Buko
3849.6b	2.56%c	%16.05c	150	
5718.1a	3.78%a	%23.62a	300	

The treatments with a common letter have no significant difference (P>0.05).

.After comparing the wet weight rate and dry weight of root of two cover crop, results showed that the highest root wet weight and dry weight was for Perko. In this study, we observed that by applying 150 kg nitrogen per hectare at a depth of 30 cm Perko had the most root wet weight (261.6 g per plant) and root dry weight (61.66 g per plant). The lowest root wet weight (55.26 g per plant) and also the lowest root dry weight (10.12 gr per plant) was for control Buko cover crop (Table 6). Buko had less root dry and wet weight than Perko. But Buko had higher root length at a depth of 60 cm. The application of 150 kg nitrogen per hectare at a soil depth of 30 cm was almost 1.5 times more effective than the application of 300 kg nitrogen in the soil depth of 30 cm on root wet weight of Perko so that less leaching was observed in this sector.

The application of 150 kg of nitrogen in the soil depth of 60 cm was effective equal to the 300 kg of nitrogen in soil depth of 30 cm on root wet weight of Perko. In addition, the application of 300 kg nitrogen values at a depth of 60 cm resulted in a further increase in root dry weight of Perko compared to the Buko. It seems likely by increasing the amount of nitrogen, its leaching and mobility was increased so that whatever the fertilizer to be placed at a greater depth of soil the root access and growth is more because the heavy soil texture at lower depths limits nitrogen leaching (Galloway, 2004; Heumann et al., 2002). The application of 300 kg of nitrogen in both 30 and 60 cm soil depth with Buko cover crop compared to Perko had lower root wet weight so that the difference was dramatic. Although, Buko root biomass was less than Perko, the comparisons showed that the ability to absorb nitrogen in the root systems of cover crop Buko was more than Perko. The most nitrogen uptake in Buko root system was observed at a depth of 60 cm and then at

30 cm depth. Perko at two 30 and 60 cm soil depth had equal ability to absorb nitrogen in its root system compared to Buko. Since plants have different ability to uptake elements, it seems that cover crop Buko has had greater ability to absorb nitrogen from the soil compared to Perko and probably it has had better yield in a warmer climate. But, the results of aerial organ biomass of Perko were slightly different from Buko. With increasing amounts of nitrogen, dry matter yield of aerial organ of Buko was increased at two soil depth 30 and 60 cm. However, generally at both 30 and 60 cm soil depth significant difference was not found on dry weight of aerial organ. Perko had more different situation and with increasing nitrogen rates the Perko dry matter was increased linearly. The dry matter of Perko was increased at a depth of 60 cm to 150 kg N ha. But by using the highest amount of nitrogen fertilizer (300 kg per ha) dry matter of Perko was decreased (Figure 2). Several studies also have shown that the enhancement of nitrogen from a certain level (level off) lead to the reduction of nitrogen use efficiency because in level off not only nitrogen is not the limiting factor but also the lack of other elements is the effective factor (the minimum Libig Act). On the other hand, according to Mitscherlich (1909) the increase in the amount of product per increase of a unit of deficit agent is appropriate to the reduction of that agent (Harmsen 2000). Therefore, it was implied that at some plants the nitrogen fertilizer efficiency at low fertilizer levels is more than higher fertilizer levels and when fertilizer consumption is more than the optimum amount, the nitrogen absorption efficiency is significantly reduced and this issue is true about Perko.

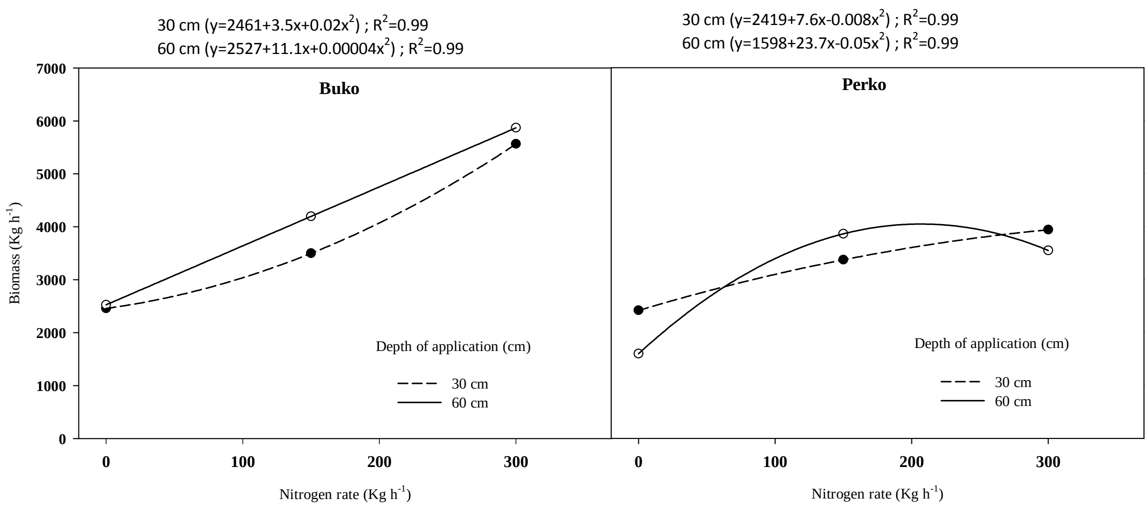

Figure 2: The comparison of total biomass of Buko and Perko plants

By comparing the effect of 30 and 60 cm soil depth on biomass status of two studied cover crop it was determined that generally two cover crop at 60 cm soil depth had high amounts of biomass nitrogen (4710Kg/ha) that in comparison with two cover crop, Buko at a depth of 60 cm had higher biomass than Perko (4198.3kg/ha). With increasing nitrogen rates the dry matter percent was decreased. An inverse relationship was observed in nitrogen consumption enhancement with the percentage of total dry matter of aerial organ of Buko and Perko (Table 5). Overall, the highest percentage of total dry matter belonged to the control plants (16.90%) because control plants had lower dry matter yield. The lowest percentage of dry matter was related to high levels of nitrogen (12.2%) (Table 7). Because by increasing the nitrogen consumption rate the dry matter yield was increased. Between two 30 and 60 cm soil depth any difference was not observed on percentage of dry matter of Buko, in the opposite Perko that at a depth of 30 cm had higher dry matter percent than 60 cm soil depth.

Table 9: The mean of binary interactions (at depth plant) on some studied traits of two cover plants

Total dry matter (Kg/h)	Shoot dry weight percent	Protein percent of aerial organs	Shoot nitrogen percent	Root nitrogen precentage		
					Depth(cm)	Plant
3246.1c	17.12a	%15.50b	2.48b	1.68c	30	Perko
3004.2d	12.60d	%16.82a	2.69a	1.56c	60	
3842.9b	15.12c	%17.35a	2.77a	2.20b	30	Buko
4198.3a	15.92b	%17.45a	2.79a	2.65a	60	

The treatments with a common letter have no significantly different(P>0.05).

After restoring cover plants on the surface of soil and measuring the amount of organic matter results showed that in the presence of two cover crop of Perko and Buko the organic matter amount was increased (Talger et al., 2009). The increase for both cover crop with increasing nitrogen rates at a depth of 30 cm was more than 60 cm soil depth. It was also observed that the cover crop Perko left more organic matter on the 15 cm soil depth (1.39%) and this amount by applying 300 kg N at a depth of 30 cm was more than the other values. Buko cover crop in the same depth and amount of nitrogen had high percent of organic carbon (1.36%). The lowest percentage of organic matter was observed at 60 cm depth of control Perko (0.53%) and then for control Buko at 60 cm soil depth (0.59%) (Table 5). The green manure returning to the soil lead to the enhancement of organic matter and carbon, total nitrogen and soil fertility that this phenomenon occurs as a result of microbiological processes and releases nutrients for plants (Talger et al., 2009).

Conclusion

The results of this research indicated that the ability of between crop plants of brassica family (Perko and Buko) is different in the use of nitrogen and nitrogen uptake from the lower part of soil. Perko at lesser amounts of nitrogen (150 kg N ha) in the upper part of the soil (depth of 30 cm) had less leaching. It seems that the root of Perko at 30 cm soil depth had greater access to the nitrogen rate in the soil. Because Perko root biomass was higher in these conditions and left more organic matter on the surface of the soil. The move to lower part of soil was increased by increasing nitrogen fertilizer. With increasing depth of soil nitrogen percent was reduced. Buko in comparison with Perko at a depth of 60 cm had higher root length. Therefore, the nitrogen uptake by the roots of the Buko nitrogen was more at this depth of soil (60 cm) and thus, prevented leaching and waste of nitrogen at this soil depth.

Additionally, the highest percentage of nitrogen of aerial organ belonged to Buko plant cover at a depth of 60 cm and with the use of high doses of nitrogen (300 kg per ha) the nitrogen absorption percentage of aerial and root organ of Buko was increased. So that whatever the more nitrogen was absorbed by plant, the protein of aerial organ was increased. Generally, Buko had higher nitrogen and protein uptake percentage than Perko. The application of 150 kg nitrogen had higher priority to higher levels of nitrogen applied for cover crops, because 150 kg N ha had the same performance to 300 kg N ha. In other words, by applying the higher levels of nitrogen in the soil, the leaching of this element has increased. In general, the suitable consumption of nitrogen to

150 kg per hectare was for both plant cover. Cover crop Buko had more ability to absorb nitrogen from the 60 cm soil depth compared to the Preko. Preko at a depth of 30 cm had better status and in smaller amounts of nitrogen at 30 cm soil depth was more capable in preventing the waste of nitrogen than 60 cm depth of soil.

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