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ECONOMIC VALUE OF PISTACHIO *(PISTACIA MUTICA*) MEAL AND ITS USING ON FEEDING OF HERBIVOROUS ANIMALS

[1]Hassan Jahanbazy Gojani, [2]Yaghoub Iranmanesh & [3]Hamed Naghavi
[1]Department of Forestry, Sari Agricultural Sciences and Natural Resources University, Sari, Iran.
[2]Natural Resources and Agricultural Research center of Chaharmahal va Bakhtiari province.
[3]Department of Forestry, Sari Agricultural Sciences and Natural Resources University, Sari, Iran

ABSTRACT
The wild pistachio is one of the economic species in Zagross region. Resin extraction of pistachio has been common activity in west and northwestern provinces of Iran. This year oil seed production and the possibility of oil extraction have done by research projects. The oil extraction of pistacia seed produces meal that this material has nutrient value. This project has done in Lordegan forests in order to determine the amount of seed production, and chemistry compositions of meal nutrient value of wild pistachio production. At first three trees were selected in each diameter class from 10-50 cm. The seed of all trees were collected to measure the amount of seed and amount of meal by oil extraction in each diameter class. According to the results the average of full seed was 3.19 Kg in different diameter classes. Average of crude protein for this nutrient material is about 35.54% and oil mean is 3.48%. The metabolism energy of this meal is about 2.84 Mc/Kg.

KEYWORDS: Meal, Seed, *Pistacia mutica*, Economic value, Chaharmahal va Bakhtiari province

INTRODUCTION

Iran country has different climate zones, so there are most variety plant species in it. This valuable source can be suitable to obviate the country's requirements through sustainable management. Nowadays the meal of oilseeds such as Soybean are used to enrichment of herbivores feed in Iran. Most of required meals are imported from foreign countries, while there is suitable potential in west of Iran for production of meal and this can produce job and obviate requirements (Baninasab and Mobli, 2008).

In western forests of Iran especially in Chaharmahal va Bakhtiari province, wild Pistachio is one of the most valuable tree species which its resin can be considered as a secondary products. If resin is extracted based on scientific standards, it will become economic. Maybe for this reason the Pistachio forests in Kurdish provinces are managed by people as garden.

In other regions of Zagros, resin extraction is carried out by non-native people, because the native people have not technical knowledge for this job. So, the Pistachio trees are frequency damaged by jobber men due to non-appropriate methods. In some provinces such as Chaharmahal va Bakhtiari where the extent of Pistachio forests is more than 90000 hectare (Talebi, 2005), this type of utilization has been inhibited because of tree disease. Previous studies showed that the seeds of Pistachio have considerable content of oil (Arefi and Mirzainadoshan, 2001). The total required oil of our country can be provided via sustainable management of pistachio forests with an area of about 2.5 million hectares (Amanpour, 2001). Besides, the people income is increased and so they are encouraged to protect pistachio forests.

In a research about some genetic properties of Pistachio, it was concluded that the production rate of oil for the different seed trees was between 20 to 39%. Moreover, the role of male parent on high production of oil was significant (Arefi and Mirzainadoshan, 2001). In another study it was reported that the production rate of full seeds and total seeds increase with increasing of diameter at breast height, but the relation of full seeds to total seeds in diameter classes of 15 and 20 cm was more than that of other classes (Jahanbazy et al., 2008).

Amanpour (2001) reported that the total area of Pistachio forests in Iran is 2.5 million hectare and this can be increased to 10 million hectare via appropriate management. He proposed that in order to produce oil, the Pistachio forests must be converted to industrial forests. After extracting oil from seeds, a large amount of residues which have nutrient value are leaved. These residues can be a suitable candidate for import of the meals of oilseeds and obviate country's requirements.

In this research, we are going to describe the nutrient value of Pistachio meals. Moreover, the oil extraction from seeds and forest management are evaluated.

MATERIALS AND METHODS

Description of the study area

This study was conducted in Oak-Pistachio forests in a region of Chaharmahal va Bakhtiari province with the name of Gavroo Ghaleh Madreseh. In geographical point of view, this region is located between 50° 31′ 24″ to 50° 31′ 39″ east longitudes and 31° 31′ 26″ to 31° 31′ 49″ north latitude. In spatial position point of view, the research site is located in the south west and at the distances of 230 kilometer from the province center, 80 kilomter from the north east of Lordegan city and 20 kilometer from the Ghaleh Madreseh village (Fig. 1).

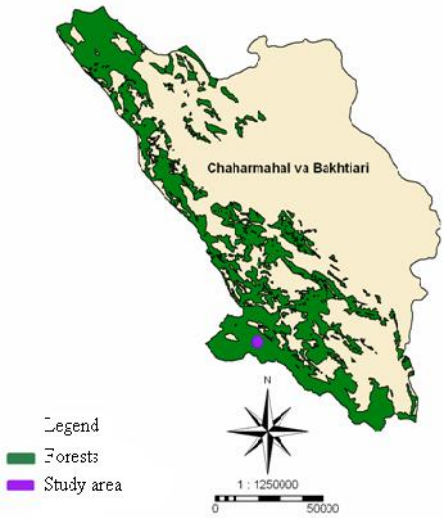

FIGURE 1: Schematic of the study area

Data collection

In forest surveying in spring of 2007, three trees were randomly selected in each diameter classes from 10 cm to 50 cm and their geographical position was recorded. Then the vegetative parameters of each tree including height, diameter at breast height, crown diameters, trunk height and number of crown branches were measured.

In this research an oak- Pistachio stand in Gavroo Ghaleh Madreseh region was selected as a study area because of the importance of conservation practices and the lower human population in this area. So, at first it was prohibited from the utilization of the seeds of marked trees. Then, the ripe and unripe seeds was collected in autumn and separately transported to the laboratory. The samples were sieved and the full seeds were separated from empty seeds. The production rate of seeds in different diameter classes was achieved via weighting. The weight of one hundred seeds and their dimensions including diameter and height was measured by micrometer. The oil was extracted from seeds under pressure and the meals of samples were separated.

The heater and under pressure machine with a powerful driving forces mauled the seeds and extracted the oil and meals from them. The meals of each sample were extracted and then transported to the laboratory of the research institute of livestock science for determining their nutrient value. In this laboratory, the oil percentage, crude proteins, ash, carbohydrate, dry materials percentage and the metabolic energy of each sample was separately estimated.

RESULT

The Mean of Vegetative Parameters of Pistachio in Different Diameter Classes

The mean height of Pistachio trees in diameter class of 10 cm and 50 cm were respectively 4.5 meter and 9 meter. The Minimum diameter of crown was related to diameter class of 10 cm. Moreover, the maximum diameter of crown (8.27 meter) was observed for trees with diameter class of 45 cm. The minimum height of trunks was 1.45 which was related to trees with diameter class of 20 cm. Besides, the maximum height of trunks was 1.90 which was related to trees with diameter class of 45 cm (Table 1).

TABLE 1: Vegetative parameters of Pistachio trees in different diameter classes

Variables	Diameter class (cm)								
	10	15	20	25	30	35	40	45	50
Height (m)	4.5	4.9	5.4	6.3	6.0	6.4	6.7	7.7	8.9
Diameter of crown (m)	3.3	4.2	5.0	6.2	6.4	6.6	7.2	8.3	7.8
Height of trunk (m)	1.6	1.6	1.4	1.6	1.6	1.3	1.6	1.9	1.5
Number of branches	4.0	5.7	4.2	5.3	8.7	9.7	7.7	7.0	11

The Relation between Diameter at Breast Height and Weight of Full Seed in Pistachio Trees

The regression for the production rate of full seed in different diameter classes was calculated. The results indicated that the equation of $Y = 3.029\ln(x) - 6.362$ with coefficient of determination 0.68 was the best relationship between these two factors for Pistachio trees (Fig. 2).

Determination of Production Rate of Seed in Different Diameter Classes

Mean production of full seeds for each Pistachio tree was 3.19 kg and the mean production of empty seeds was 1.33 kg. Maximum production of full seed (5.31 kg) was related to diameter class of 30 cm and the minimum rate (0.86 kg) was recorded for diameter class of 10 cm. Moreover, maximum rate of empty seed production (2.58 kg) was recorded for diameter class of 40 cm and the minimum rate (0.54 kg) was recorded for diameter class of 10 cm (Table 2).

Statistical Comparison of Dimensions and Production Rate of Seed in Different Diameter Classes

Duncan test also showed the grouping status of diameter classes and the statistical difference among them for production of full seeds (Table 3). Statistical comparison showed that among measured parameters of seed, only the production rate of full seed had significant difference at probability level of 1% in different diameter classes (Table 4).

Elements and Former Materials of the Meal of Pistachio Seed

After decomposing of the 27 sample meals (yield from Pistachio seeds) in different diameter classes, it was proved that the residues had nutrient value. The mean crude protein of this nutrient was 35.54%. Moreover, the amount of fat and the metabolic energy were respectively 3.48% and 2.84 Mc/kg. The amount of other constituents in different diameter classes is illustrated in Table 5.

FIGURE 2: Relation between Diameter at Breast Height and Weight of Full Seed

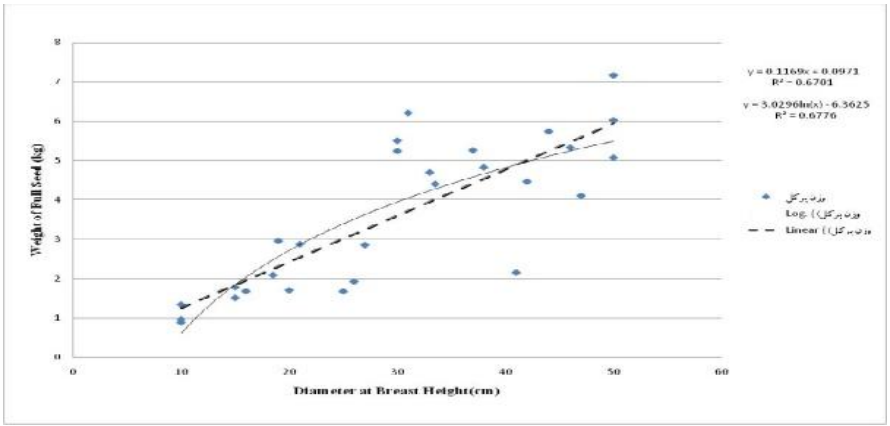

TABLE 2: Mean production rate of full and empty seeds in different diameter classes

Variables	Diameter class (cm)								
	10	15	20	25	30	35	40	45	50
Full seed (kg)	1.1	1.6	2.4	2.1	5.6	4.8	3.8	5.0	6.1
Empty seed (kg)	0.7	0.7	0.9	1.2	1.2	1.2	2.1	1.4	1.9

TABLE 3: Comparison of the mean production of full seeds in different diameter classes based on Duncan tes

Diameter class	Number	Statistical level of 1%		
		Group 1	Group 2	Group 3
10	3	1.06		
15	3	1.65		
20	3	2.15		
25	4	2.40		
30	3		3.81	
35	3		4.78	4.78
40	3		5.05	5.05
45	3			5.65
50	3			6.08
Sig.		0.055	0.066	0.062

TABLE 4: ANOVA for the Pistachio seeds in different diameter classes

Variable		SS	DF	MS	F	Sig.
Seed diameter	Among groups	2.44	8	0.3	1.37	0.272^{ns}
	In groups	4.25	19	0.2		
	Total	6.69	27			
Full seed	Among groups	84.4	8	10	18.64	0.00^{**}
	In groups	10.8	19	0.6		
	Total	95.2	27			
Empty seed	Among groups	5.76	8	0.7	1.39	0.264^{ns}
	In groups	9.87	19	0.5		
	Total	15.6	27			

TABLE 5: Nutrient value of the meal of Pistachio seed

Diam. class	Ash (%)	ADF (%)	NDF (%)	Fat (%)	Crude protein	Dry matter	Metabolic energy

					(%)	(%)	(Mc/kg)
10	6.7	19.2	31.4	2.9	34.12	93.40	2.76
15	6.6	17.3	29.5	3.8	35.43	91.87	2.82
20	6.4	17.5	29.6	3.6	33.48	92.75	2.85
25	6.3	17.3	29.3	3.3	35.76	91.49	2.93
30	6.4	17.3	29.2	3.3	35.90	91.97	2.79
35	5.7	17.6	29.3	3.1	34.66	91.05	2.83
40	6.8	16.2	28.1	3.9	36.70	91.73	2.88
45	6.5	16.6	28.9	3.1	36.59	91.15	2.80
50	6.1	16.6	28.8	4.2	37.20	91.30	2.94
Mean	6.4	17.3	29.3	3.5	35.54	91.86	2.84

Comparison of the Nutrient Value of Pistachio Meals and the Other Oilseeds Meals

The use of the meals of oilseeds for feeding livestock is a usual activity around the world. Nowadays the nutrient value of the soybean meals is more than that of other oilseeds (Nikkhah and Amanlo, 2001). In this study we compared the nutrient value of Pistachio meals and the other oilseeds meals. The results in Table 6 show that the total constituents of Pistachio meals were similar to the means of other oilseeds. The amount of crude protein, carbohydrate and metabolism energy in soybean meals was near to Pistachio meals. For example, the percentage of NDF in Pistachio meals was more than that of soybean meals. This case indicates that the amount of Hemicelluloses in Pistachio is more than that of soybean. Moreover, the rate of metabolism energy in Pistachio was more than that of other oilseeds, except for soybeans. In spite of the crude protein of Pistachio was 10% lower than soybeans, but was similar to other oilseeds.

TABLE 6: Comparison of the nutrient value of Pistachio meals and meals of some oilseeds

Meal	Ash (%)	ADF (%)	NDF (%)	Crude protein (%)	Dry matter (%)	Metabolic energy (Mc/kg)
Pistachio	6.41	17.1	29.2	35.61	91.68	2.83
Kolza	7.40	20.5	29.8	37.80	90.30	2.75
Gossypium	6.70	19.9	30.8	44.90	90.50	2.70
Golrang	14.5	39.1	53.8	29.00	93.50	1.96
Soybean 1	5.50	10.4	21.7	46.30	89.60	3.61
Soybean 2	6.60	10.0	14.9	49.90	89.10	3.31
Sunflower	7.70	30.0	40.3	28.40	92.20	2.24

TABLE 7: Estimation of the production rate of Pistachio oil in different diameter classes

Variables	Diameter class (cm)								
	10	15	20	25	30	35	40	45	50
Meal production (%)	73	72	72	70	68	69	73	71	65

Estimation of the Production Rate of Pistachio Mealsin Different Diameter Classes

According to the percentage of oil production and seed moisture (approximately 10%), the amount of meals production in each diameter class was calculated. The minimum production of meals was 65.19% which was observed in diameter class of 50 cm. besides, the maximum production of meals was 73.15% which was observed in diameter class of 40 cm. After oil extraction, 70% of seeds are converted to meal (Table 7).

DISCUSSION

Wild pistachio species have edible fruits usable both as human and animal feed. A resin type juice is extracted from the tree stems usable in pharmaceuticals, gums, paints, pesticides, pastes, perfumes and mineral oil industries (Bahrani et al., 2010). It was proved that among the key socioeconomic characteristics of the households, increased educational status and cash incomes from sources other than the woodland are associated with less dependency on the woodland resources, and consumption of energy has a positive correlation with the collection of fuel wood (Salehi et al., 2010).

During three previous decades, one of the main aims of government was to develop the Pistachio forests from 2.5 million hectare to 10 million hectare. This purpose couldn't be conduct because of the operational problems (Amanpour, 2001). In recent two years, the forests and rangelands research institute provided two oil extraction machines which work using under pressure system. The finance section of this project was supported by general office of natural resources in Kurdistan province.

Oil extraction from wild Pistachio causes to produce meals which have high nutrients value. The attempts of this were to measure the production rate of seeds, oil and meals in different diameter classes of Pistachio. According to the effects of the trees age and dimensions on production rate, different regression models among vegetative parameters and production rate of seed was determined. Results showed that the rate of oil and meals increased with increasing seed production (Esmailkhanan and Emadi, 1995).

There was regression equation Y = 3.029ln(x) - 6.362 for the diameter at breast height and the rate of Pistachio ripe seeds. This equation shows that the environmental factors and the location of trees lead to decrease coefficient of determination. Also, results demonstrated that the amount of ripe seeds increased with increasing trees age and dimensions.

For many years, the Iranian Forest Service has been implementing forest management plans in Zagros forests using a number of different approaches. These have met with limited success owing to conflicts of interest and expectations between the local communities and the forest service. So, the traditional forest management can offer sustained yield and can be prescribed for sustainable forest management in northern Zagros with some modifications (Ghazanfari et al., 2004).

Seed production is a function of vegetative conditions and environmental factors. In this study the mean production of ripe and empty seeds for each Pistachio tree in different diameter classes was respectively 3.19 kg and 1.33 kg. Other studies showed that the mean production of seed is variable. The mean production rate of seeds in a Pistachio tree in Sar Chahan region of Fars province was 13.4 kg and for Fasa was 7 kg (Nemati and Bordbar, 2003).

CONCLUSIONS

Pistacia mutica is an important species in Zagros Forests, environmentally and economically. For this reason, its plantation at governmental and private levels is recommended (Fattahi, 2003). In summary we found that the average of full seed of *Pistacia mutica* was 3.19 Kg in different diameter classes. Average of crude protein for this nutrient material is about 35.54% and oil mean is 3.48%. The metabolism energy of this meal is about 2.84 Mc/Kg.

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