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The Feasibility of Applying Green Manure in Tehran City (Municipal) Region No.2 Based on Experts' Points of View

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ABSTRACT

The main purpose of this study was to determine the feasibility of applying green manure in Tehran City (municipal) Region No. 2 based on experts' points of view. The statistical population of this study included all experts from Tehran City (municipal) Region No. 2 (N = 80). A questionnaire was the main instrument of this study, and data were collected by interview. The validity of the questionnaire was confirmed by a panel of experts, and its reliability was approved by a Cronbach's alpha coefficient within the range of 76% -93% using SPSS (v.16) software. To identify factors affecting the application of green manure in urban green spaces, factor analysis was used. Policy-making, educational - extensional, socio-cultural, protective, economic, participatory, environmental and biological factors determined 75.7% of the variance in the perception of respondents regarding the application of green manure in urban green spaces.

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INTRODUCTION

Human beings are one of the biggest causes of pollution, destruction and threats to the environment. Human interventions in nature have resulted in irreparable damages to life on Earth. Reduction in the thickness of the ozone layer, the effect of greenhouse gases, drying of wetlands', desertification, destruction of forests, salinization of fertile soils, decreased freshwater resources and, increased use of pesticides and fertilizers, together with hundreds of other examples, are the results of man's activities [1]. Obviously, one of the major causes of this problem is a lack of human awareness about the deleterious effects of our actions on nature. Thus, in order to avoid the threatened disasters, public knowledge and awareness should be improved, so that by changing attitudes towards the environment, people will become more diligent in protecting it rather than destroying it. In the field, by providing the necessary education, the creation and development of an environmental culture within societies and the authorities that manage them can be encouraged (ibid).

In recent years, concerns have also arisen about soil degradation as the only source for the supply of the world's food, so that in the Universal Food Declaration, soil fertility is cited as one of the key factors for achieving food security and sustainable farming; Therefore, any method that can help to increase and maintain the soil's organic matter, should to be welcomed. For example, applying green manure is one such approach [2]. Green manure means ploughing plants in to soil after sufficient growth and without harvest. Green manure has effects on the physical properties of soil, similar to animal manure, without entailing the negative consequences arising from the use of chemical fertilizers [3].

Green manures also provide a great habitat and food supply for insects that are needed to naturally control pests when the ground is free from vegetation [4]. In fact, due to fertilizers' quick impact, farmers ignore the consequences of such fertilizers and do not use organic fertilizers to improve the physical, chemical and biological properties of soil. This has caused farming soils to become too hard and caused reduced soil permeability as environmental consequences. This situation causes further damage to soil structure and the soil becomes heavy. Therefore, promoting and developing a culture based on the use of organic (green) fertilizers instead of chemical fertilizers among farmers is essential, as soil poverty, in terms of trace organics, has in most areas of Iran caused the soil structure to develop conditions un favorable to root growth, leading to declining

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performance [3]. Worldwide, more than 400 million tons of chemical fertilizer is produced and consumed each year. In our country, every year, more than 4.5 million tons of subsidized fertilizer is distributed among farmers. According to experts, the actual consumption of fertilizers in the country is more than wise the amount reported Due to the cheapness of chemical fertilizers and farmers' lack of information about them; their adverse effects have grown exponentially each year [5]. Unfortunately, many years of the excessive use of chemical fertilizers, especially nitrogen and phosphate materials, compounded by non-compliance with basic principles of agriculture science that require the balancing of nutrients in the soil , has caused irreparable damage to soil, and thus to the country's agriculture.

Currently, despite the fact that the use of chemical fertilizers in Iran is above average in terms of consumption worldwide (110 kg per hectare), and is equivalent to the average consumption in developed countries (116 kg per hectare), production per unit area is much lower than that of the developed countries, mainly due to farmers ' lack of awareness and, lack of understanding of the precise fertilizer needs of agricultural plants, and the unavailability of the fertilizer supplies that are appropriate to their needs [6]. Another disadvantage of the use of chemical fertilizers can be a reduction in the water retention capacity of the soil, increasing soil erosion and decreasing resistance of plants and crops to pests [7].

Tehran, as the capital city and largest metropolitan center, has in past decades, attracted a large population and many, privileges and, facilities; consequently, it also faces a number of problems; they include poor soil management practices and soil erosion in the green spaces in Tehran [7]. The mission of the geology department of parks and green space is managing soil and preventing soil erosion in the green space of Tehran, so that choosing appropriate fertilizer and plant selection can be based on knowledge of the characteristics of soil and water so that the optimal context for plant growth is established and limitations in the plant bed are resolved or overcome, leading to better growing conditions [8].

Dehghani Meshkani *et al* (2011) showed in a study that the use of bio-fertilizers increases the yield and quality of chamomile, and significantly increases plant height, size and diameter of the Capitol, as well as increasing the quantitative yield of plants, including shoots' dry weight. The use of bio-fertilizers can lead to reduced consumption of chemical fertilizers in the agricultural ecosystem [9].

Ismaili (2007) concludes in his study that there is a significant relationship between variables of age, education level, access to awareness raising resources, and training methods, and variables dependent on citizens' knowledge about building a healthy environment. Also there is a significant relationship between the informative resource variables and the training methods available to citizens to learn about building a healthy environment [10].

Nasiri (2009) also argues in his study that a lack of community involvement is one of the constraints in using green manure. Variables such as community participation in decision- making are also factors that have an influence on the adoption of bio-fertilizers [11]. Anandajayasekeram *et al*. (2007) believe that holding training courses helps the participants' attitudes and perceptions to improve and facilitates their relationship with researchers and extension agents. This factor also has a significant impact on the adoption of new technologies [12]. Wu *et al*. (2005) showed in their study that the use of biological fertilizers improves soil's physical structure and the content of organic matter and nitrogen available to the symbiotic plants. Manure management is a key factor in the successful cultivation of medicinal plants [13]. The present study is important since it provides a theoretical framework for the low-input sustainable agriculture in urban green space, the conservation of natural resources and the decrease of soil erosion, leading to improvement in the quality of human life.

Research objectives:

Therefore, identifying and analyzing the factors affecting the use of green manure in urban green spaces in Tehran from the perspective of experts and providing solutions to solve these problems though developing this project are the main objectives of this study. More specific objectives include investigating the personal characteristics of the experts and analyzing factors affecting the use of green manure in urban green space from the experts' perspective.

MATERIALS AND METHODS

The present study is an example of applied research and in terms of research methods is a descriptive survey using factor analysis. The data collection tool is a questionnaire. To develop the questionnaire, the theoretical bases were first evaluated according to the literature then, in order to acquire the results of the study, a preliminary questionnaire was developed. After ensuring reliability and validity, and making revisions, the final questionnaire was designed. To investigate the validity of the study tool, the designed questionnaire was provided to the researchers' supervisor and advisor. This resulted in further necessary reforms and the changing of some of the questions, after which the validity of the questionnaire was confirmed. To test the reliability of the instrument, a total of 25 questionnaires were completed by experts on landscaping, and Cronbach's alpha was calculated (in the range of 0.76% -0.93%). This was an appropriate reliability coefficient for this study. The

population of the present study was all experts in District 2 of the Tehran municipality; their total number was 80. Due to the limited number of experts, all of them were included in the sampled census. SPSS16 software was used to analyses the collected data. In terms of descriptive statistics, mean, standard deviation and coefficient of variation, (CV) were used, and in inferential statistics, exploratory factor analysis was used.

Results Investigation of personal characteristics of experts:

Sex: According to the study results, 47.5% of the experts were women and 51.3% of them were male.

Education: The results shows that 67.1% experts has a bachelor's degree; 27.8% have a master's degree and 5.1% have a Ph.D. Degree of information about green manures (non-chemical): findings of the study suggest that, 1.3% of the experts rated their degree of information green manures (non-chemical) as very little, 12.5% as little, 47.5% as average, 36.3 % as much and 2.4 % as very much.

Age: Based on information gathered, the mean age of the experts is 34 years; the youngest is 24, and the oldest 54.

Job Experience: Based on the information gathered, the mean job experience of the experts is nine years; the lowest was one year and the highest was 33 years.

Table 1: Description of the demographic characteristics of the respondents (n=80)

variable	mean	Standard deviation	median	index	minimum	maximum
age	34	6.05	33	30	24	54
job experience	9	5.83	8	6	1	33

Experts' perspectives on factors affecting the application of green manure in urban green space

In order to understand the experts' perspectives on the factors affecting the use of green manure in urban green space, a, 40-item Likert scale was used. Considering points between very much [5] and very little [1], the minimum and maximum scores for each respondent were 40 = 1 × 40 and 200 = 5 × 40 respectively. Therefore, all items were summed and coded together again, so that scores were classified as 71-40 (very little), 104-72 (little), 137-105 (average) 170-138 (much) and 203-171 (very much). Results of the study indicate that the majority of the experts (46.5%) believe that the factors mentioned have great impact on applying green manure in urban green space.

Table 2: Experts' perspectives on the factors affecting the use of green manure in urban green space. (N =80)

Evaluation spectrum	Frequency	Percent	Valid percent	Accumulative percent
Very little (40-71)	1	1.3	1.4	1.4
Little (72-104)	3	3.8	4.2	5.6
Average (105-137)	11	13.8	15.5	21.1
Much (138-170)	33	41.3	46.5	67.6
Very much(171-203)	23	28.8	32.4	100
Without response	9	11.3	-	-
Total	80	100	100	-

Evaluation spectrum: very little (40-71), little (72-104), average (105-137), much (138-170), very much (171-203) Median: much index: much

Rating the perspectives of experts on the factors affecting the use of green manure in urban green space

The results of the findings show that the most important factors affecting the use of green manure in urban green space are the prevention of the hardening of arable soil, the maintenance of long-term productivity, and the prevention of environmental pollution and gradual degradation of soil quality, with change coefficients of 0.198, 0.200 and 0.202, respectively. The rest of the items are lower priorities (Table 3).

Table 3: Rating the perspectives of experts on the factors affecting the use of green manure in urban green space.

Rating	Factors affecting the use of green manure in green space	Mean	Standard deviation	Change coefficient
1	Prevent hardening of arable soil	4.08	0.81	0.198
2	Maintain long-term productivity and prevent environmental pollution	4	0.80	0.200
3	No gradual degradation of soil quality	4.10	0.83	0.202
4	Increase the resistance of plants to disease and aquatic stress	3.83	0.92	0.2402
5	Positive attitudes and beliefs of experts toward bio fertilizers	4.03	0.97	0.2406
6	Preserving and re-cycling plant nutrients	3.97	0.89	0.2241
7	Increasing water use efficiency of plants	3.78	0.85	0.2248
8	The collaboration between farmers, researchers, extension agents and policy makers in planning and implementation	4.21	0.95	0.225
9	Protecting the soil from erosion	4.03	0.93	0.230
10	Increasing the water holding capacity of the soil and increasing nutrient retention capacity of the soil	3.92	0.91	0.232
11	Having appropriate management in the organization of parks and	4.16	0.97	0.233

	green space for implementing projects related to green manure			
12	Increasing food and water absorption	3.96	0.93	0.234
13	Pollution and soil degradation due to indiscriminate use of chemical fertilizers	3.96	0.96	0.242
14	Holding training courses for experts in the use of green manure in green space	4.03	0.98	0.243
15	Holding conferences, seminars and training courses for experts in the field of landscaping on the use of green manure, green manure	3.98	0.99	0.248
16	Private sector's participation in order to utilize features and capabilities	3.95	1	0.253
17	Experts' visiting from successful initiatives in the use of green manure rather than chemical fertilizers	4.01	1.02	0.254
18	Boosting root growth	3.81	0.98	0.2572
19	Government support through establishing workshops and research centers	4.08	1.05	0.2573
20	High price of green manure compared to animal manures and chemical fertilizers	3.72	0.96	0.258
21	Ratification of laws and regulations that protect green manure	3.96	1.03	0.260
22	Publication of books and articles related to use of green manure instead of chemical fertilizers in urban green spaces by the parks and green spaces organizations of Tehran	3.83	1.02	0.266
23	Planning at all levels (national, local, regional) in the use of green manure rather than chemical fertilizers	4.08	1.09	0.267
24	Provide cooperation context for relevant organizations in the implementation of green manure	3.80	1.02	0.268
25	Promotion of agricultural technologies by government	4.01	1.08	0.269
26	Economical advantage	3.80	1.04	0.273
27	Government support in the use of these fertilizers	4.05	1.11	0.274
28	Giving necessary knowledge and expertise to the landscaping contractors in relation to the advantages of green manure	3.82	1.08	0.282
29	Using advertisements on the use of green manures	3.87	1.13	0.291
30	Preparing CDs and providing training in the use of bio fertilizers by the green space organization	3.76	1.10	0.292
31	Correct culture in relation to the use of green manures	3.71	1.10	0.2964
32	Easy access to biological factors	3.81	1.13	0.2965
33	Familiarity with sustainable agriculture	3.70	1.10	0.297
34	Culture of using bio fertilizers in society	3.86	1.20	0.310
35	Sense of responsibility in people towards urban green space	3.81	1.22	0.3202
36	Social partnership between experts in landscaping with contractors to use green manure	3.71	1.19	0.3207
37	Fair and economic trade sales in relation to green manure	3.61	1.19	0.329
38	Government support for biofuel production as subsidies	3.53	1.28	0.362
39	Allocating appropriate financial resources and investment to related organizations	3.53	1.34	0.379
40	To rely solely on chemical control	3.41	1.30	0.381

Evaluation spectrum: 1 = very little, 2 = little, 3 = average, 4 = much, 5 = very much

Factor analysis of the factors affecting the use of green manure according to urban green space professionals

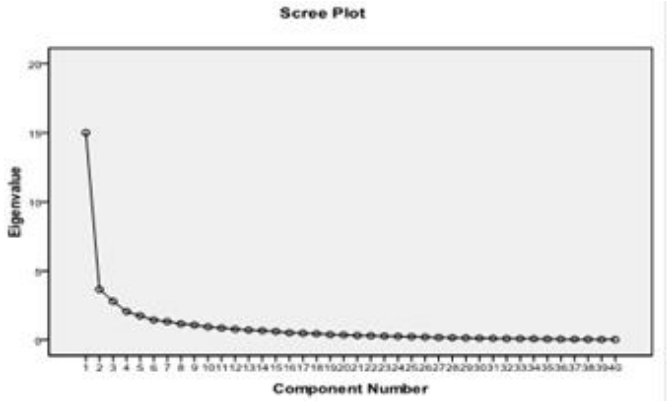

Fig. 1: Scree plot graph to determine the number of factors Source: research findings.

In order to determine the most important factors that influence the application green manure in urban green space from the perspective of experts, factor analysis was used. Calculations given in Table (4) show that for

determining the internal consistency of the data in factor analysis, KMO and Bartlett's tests were used. The calculated rate of KMO (0.779) and the value of its Bartlett (2402.772) were significant ($P < 0.001$), which shows good correlation of variables for factor analysis. As Figure 1 shows, for determining the factors, a graph (scree plot) of eigenvalues and percentage variance was used. Based on this, eight factors were identified which in total account for, (75.7 percent) of the total variance.

Also, as shown in Table (4), according to the Kaiser criterion, eight factors that had eigenvalues above one for factors affecting green manure in urban green space were obtained. After factor rotation by the varimax method of rotation, variables relating to the factors influencing the use of green manure in urban green space from the perspectives of experts were classified into eight factors.

Table 4: Extracted factors, eigenvalue, percentage of variance and cumulative variance of components affecting use of green manure in urban green space.

Factors	Eigenvalue	Percent of variance of eigenvalue.	Percent of cumulative variance.
First	5.286	13.214	13.214
second	4.495	11.238	24.453
third	4.494	11.235	35.687
fourth	4.078	10.194	45.881
fifth	3.141	7.853	53.734
sixth	2.389	5.973	65.844
seventh	2.004	5.011	70.854
eighth	1.976	4.939	75.793

Source: research findings

The first factor with the eigenvalue 5. 286 determines 13.2% of the total variance (Table 4). The first factor had the highest proportion (5.2%), and the eighth factor had the lowest proportion (1.9%).Of all the variables, these eight factors explain 75.7 % of the total variance of the variables, suggesting a high percentage of variance is explained by these factors.

The condition of the variables (40 main variables) in the factors with factor loadings is assumed to be larger than 0.5; after factor rotation by varimax method and the classification of factors it is as shown in Table (5). Therefore, these factors can be summarized in terms of the other variables. Considering the constituent variables of the f actors, the first factor is called the policy making factor, the second factor is educational promotional, the third factor is called the cultural social factor, the fourth factor is called the protective factor, the fifth factor is called the economic factor, the sixth factor is called the collaborative factor, the seventh factor is called the environmental actor and the eighth factor is called the biological factor.

Table 5: Variables related to each factor and the coefficients obtained from the rotated matrix.

Factor name	Variables	The rate of coefficients (factor loading)
Policy making factor (X1)	Consumer protection laws and regulations of green manure	0.801
	Providing cooperation contexts with relevant organizations in the implementation of green manure plans	0.769
	Government support through establishing workshops and research Centers	0.729
	Planning at all levels (national, local, regional) in the use of green manure	0.721
	rather than chemical fertilizers	0.685
	Having appropriate management in the organization of parks and green space for implementing projects related to green manure	0.685
	Promotion of agricultural technologies by government	0.559
	The private sector's participation in order to utilize features and capabilities	0.503
	Using advertisements on the use of green manure	
Educational-promotional factor (X2)	Holding training courses for experts on the use of green manure in green space	0.770
	Giving the necessary knowledge and expertise to the landscaping contractors in relation to the advantages of green manure	0.737
	Holding conferences, seminars and training courses for experts in the field of landscaping on the use of green manure, green manure	0.721
	Experts' visiting from successful initiatives in the use of green manure rather than chemical fertilizers	
	Preparing CDs and providing training in the use of bio fertilizers by the green space organizations	0.680
	Publication of books and articles related to the use of green manure instead of chemical fertilizers in urban green spaces by the parks and green spaces organizations of Tehran	0.554
		0.502
Cultural-social factors (X3)	Cculture of using bio fertilizers in society	0.819
	Easy access to biological factors	0.712
	Correct culture in relation to the use of green manures	0.696
	Positive attitudes and beliefs of experts toward bio fertilizers	0.647
	Familiarity with sustainable agriculture	0.589
	Government support in the use of these fertilizers	0.558

Protective factor (X4)	No gradual degradation of soil quality	0.796
	Prevent hardening of arable soil	0.795
	Boosting root growth	0.718
	Increasing food and water absorption	0.710
Economic factor (X5)	Government support for biofuel production and subsidies	0.844
	Economical advantage	0.816
	Allocating appropriate financial resources and investment to related organizations	0.810
		0.737
	High price of green manure compared to animal manures and chemical fertilizers	0.701
		-
	Fair and economic trade sales in relation with green manure	-
Collaborative factor	The collaboration between farmers, researchers, extension agents and policy makers in planning and implementation	0.773
	Social partnership between experts in landscaping and contractors to use green manure	0.560
Bioenvironmental factor (X7)	Pollution and soil degradation due to indiscriminate use of chemical fertilizers	0.670
	Maintain long-term productivity and prevent environmental pollution	0.546
	Increasing water use efficiency of plants	0.525
Biological factor (X8)	Increase the resistance of plants to disease and aquatic stress	0.764
	Increasing nutrient retention capacity of the soil	0.745

Source: research findings

Discussion and conclusion:

By conducting factor analysis of 40 variables, the factors affecting the use of green manure in urban green spaces were divided into eight factors. The factor analysis of the components of the factors affecting the use of green manure in urban green spaces, showed that 75.7% of changes are related to the eight factors of policy making, educational- promotional, cultural – social, protective, economic , collaborative, environmental, and biological. The first factor alone, with eigenvalues of 5.28, explains 13.2% of the total variance; it can be concluded that policy making affects the use of green manure in urban green space more than other factors. In accordance with the present study, Ajoodani (2009) argues that providing cooperation with relevant organizations in the implementation of green manure and the introduction of laws that support bio-fertilizers are political factors affecting the application of green manure [14].

Since, in Ajoodani's (2009) study, the context for the development and promotion of organic farming was been considered, it is similar the present study. Khedri (2010) found in a study that holding training courses, seminars and conferences for landscaping experts on using green manure can be effective in applying green manure [15]. The present study , regarding requirements for the adoption of low-input agriculture from experts' perspectives, is similar. The results of the study by Khorramdel *et al* (2010) are consistent with the present research [16]. The findings of the study by Taghvai *et al* (2010) show that there is a significant relationship between a person's sense of belonging to a living place and the extent of their participation in urban management [17].

Since in that study, the factors affecting citizens' participation are taken into consideration, it is similar to the present study. Ismaili (2007) in his study concludes that there is a significant relationship between the variables of awareness raising resources with the dependent variable of citizens' knowledge about building a healthy environment. Also, there is a significant relationship between the variables of informative resources and training methods with the dependent variable of citizens' skills in building a healthy environment [10]. The present study, considering the role of public education in building a safe environment, is similar. Anandajayasekeram *et al*. (2007) argue that holding training courses has a significant impact on the adoption of new technologies [12]. Sharma *et al*. (2005) in their study concluded that there is a significant positive relationship between mass education methods and the adoption of farming technology [18]. Wu *et al*. (2005) showed that the use of biological fertilizers improves the soil's physical structure as well as the content of organic matter and the nitrogen available to the symbiotic plant [13]. Nasiri (2009) also argues in his study that the lack of community involvement is one of preventative factors to using green manure. Variables such as

Community participation in decision making are factors that have an influence on the adoption of bio-fertilizers [11].

Recommendations:

According to results of the present study and the impact of various factors on use of green manure, the following recommendations are offered:

- Government support through establishing workshops and research centers in the use of green manure in urban green spaces
- Planning at all levels (national, regional and local) in the use of green manure rather than chemical fertilizers
- Providing appropriate management in organizations for the implementation of green manure plants

- Holding appropriate training courses in the use of green manure for green space professionals to increase their knowledge and awareness about this issue
- Experts should visit from successful initiatives in the use of green manure rather than chemical fertilizers
- Extending the culture of using green manure through individual and group media (bio-fertilizer)
- Teaching experts and contractors that green manure decreases the gradual degradation of soil quality, prevents hardening of arable soil, and improves root growth and the soil's protection from erosion.
- Allocating appropriate financial resources and investment to related organizations
- Reducing the price of green (bio) fertilizers for easy use by farmers and experts
- Collaboration between experts, researchers, advocates and policy-makers in planning and implementation decisions
- Building a culture in the field of using green (bio) fertilizers among experts and contractors

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