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Locating Of Suitable Agriculture Implements on the Flat and Sloping Lands of the Villages of Mahabad with GIS Software

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LOCATING OF SUITABLE AGRICULTURE IMPLEMENTS ON THE FLAT AND SLOPING LANDS OF THE VILLAGES OF MAHABAD WITH GIS SOFTWARE

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Abstract

The purpose of this study is to find suitable agricultural equipment in flat and steep areas of Mahabad villages by GIS software. This research is a kind of applied research. The research design is descriptive (non-experimental). The statistical population of the present study consists of 50 experts in the field of agricultural machinery working in the field of agriculture and agricultural machinery. The tool used to collect data was paired comparisons and spatial information extracted from files which are relevant to data of spatial layers file type. The data analysis method includes hierarchical analysis in expert choice software and the suitability of agricultural equipment and location with ARC GIS software. The research findings show that the most important factor in selecting agricultural equipment in terms of land slope characteristics. The relative weight index for this criterion is 0.399 which is larger than the other criteria. Then the soil type and its material are more important. Finally, land elevation factor can also be considered as the weakest criterion. Characteristics of agricultural equipment maneuverability of agricultural equipment are the most important factors in selecting agricultural equipment and in proportion to land field. The relative field weight index for this criterion is 0.228 which is larger than the other criteria. Paying attention to the price of machinery and equipment is an important factor and to the power factor of the machine is the third factor after that it should pay attention to the maintenance cost factor.

Keywords: Agricultural equipment, Agricultural equipment locating, flat and sloping land, GIS software

1. Introduction

Despite the great importance of machine technology in agriculture, government policies in recent years have led to inadequate supply of machinery to the agricultural sector. The rate of providing agriculture sector with machines in recent years has not only failed to realize the mechanization programs but also has not been responsive to the depreciation of the machinery. In spite of mentioned items, the degree of mechanization in agricultural operations has increased in recent years, reflecting the current role of agricultural machinery and agricultural mechanization in agricultural development. [1]

In the past few decades, agricultural machinery has entered various stages of production and has become an integral part of agricultural structure in Iran, but in recent years machinery supplying difficulties with and disadvantages such as inadequate supply of agricultural machinery. This leads to some negative effects agriculture, also the use of agricultural machinery is an important factor in the advancement of mechanization goals, in which the level of literacy of farmers is significant [2].

The lack of systematic approach in proportion between equipment and land use has led to inefficient use of resources and factors so production efficiency has not been achieved [3].

In this study, the researcher tries to provide different maps of the agricultural of Mahabad according to the used machines in this region the researcher is able to find suitable machines agricultural equipment used in the area, to optimize the location for using agricultural equipment to pay.

Various agricultural operations require a variety of suitable tractors of suitable tractors to work successfully. The purchase of tractors and associated equipment can be described as a significant investment for agricultural land. Using much smaller tractors will result in a large amount of time on the ground and delay in operation, and on the other hand, the choice of larger tractors required for the land will result in severe on-ground operations and high costs, thus choosing the wrong size of machinery will be very costly. Until now, different methods have been used to select a suitable tractor such as considering different technical criteria, and selecting the best model with multi-criteria decision-making techniques. In the course of research, a type of tractor for a wide area is considered. It has been taken while in a large area it is possible to use several models of the same tractor type. This study will try to study the current situation, the slope of land and the variety of equipment used in the whole villages of Mahabad and study on topographic situation of the area to find a suitable model for selecting a tractor model from a suitable factory..

Choosing the correct location for the activity is one of the important decisions for implementing a large-scale project and requires site-based research from a variety of perspectives and by providing an appropriate methodology. The choosing optimal site is feasible. Presenting a methodology makes the process of selecting the optimal location for deployment fully so that the final decision maker can ensure the process of location choice was accurate and comprehensive, not only based on his personal judgments.

General purpose of the research: Determining of agricultural equipment relevant to the cultivated lands in Mahabad villages using GIS software.

1. First objective: Determining of agricultural equipment relevant to the slope of cultivated land in Mahabad villages using GIS software.

2. Second objective: Determining of agricultural equipment relevant to soil type of cultivated land in Mahabad villages using GIS software.

3. Third objective: Determining of agricultural equipment relevant to the height of cultivated land in Mahabad villages using GIS software.

4. Fourth objective: Determining of agricultural equipment relevant to machine power in Mahabad villages using GIS software.

5. Fifth objective: Determining of agricultural equipment suitable for maneuverability of machines in Mahabad villages using GIS software.

2-Original text

GIS refers to a set of tools that can be used to store, selectively retrieve, transfer, and display spatial data. Not long ago, these systems were used only by geographical and mapping scientists. Today, however, various organizations and companies have developed systems and software that have commercial uses and are widely used in retail environments [4].

Using GIS through digitized maps with a set of key spatial data displays graphical characteristics such as customer demographic characteristics, data on their purchase volume, current and hypothetical competitors' location, and so on in an acquisition a trading field. GIS software allows retailers to quickly explore the attractiveness of different locations and view their findings on a computer screen in a series of maps [5].

Recently, with the changes in the retail environment, many retailers have turned to GIS software. GIS today comes in many ways with the help of retailers and plays an important role in achieving their business goals. Customer development, improved service quality, increased customer satisfaction, continued business growth and ultimately increased profitability are some of the most important goals that retailers seek to achieve. GIS helps retailers in a variety of ways by supporting strategic plans and decisions. In general, GIS is useful in a variety of tasks such as market analysis, customer analysis, competitor analysis, centralized marketing (advertising), business development planning, placement for new branches supervise on performance of branches of customer relationship management branch distribution system management, etc [6].

The Global Positioning System is a satellite navigation system consisting of a network of 24 orbiting satellites 11,000 miles in six different orbits. It is a satellite navigation and navigation system consisting of a network of 24 satellites, built by the US Department of Defense and placed in orbit. The system was originally designed for military use, but was released to the public in 1980 [7].

Site selection means determining the geographic location for an enterprise's operations. This process involves identifying, analyzing, evaluating, and choosing among different options. Locating centers means finding the right location for new or existing ones, taking into account existing centers and the constraints that exist in the most economical feasible location and making competitiveness is one of the key goals. Considering that site selection is defined as choosing a new site for new centers that minimize the cost of producing and distributing goods or services to potential customers [8]. The final decision is always made on the basis of evaluating the objective (quantitative) and subjective (qualitative) factors of each of introduced the introduced places in the selection [9].

In general, the types of locating problems have specific goals and some of the factors are more important. Therefore, it can be said that the goals are important in identifying and prioritizing decision criteria in a location problem and its sub-criteria. They have an important role. In segmentation, the objectives of the locating problems are divided into three categories for the based mathematical programming approach and the objective function types.

Positioning-routing problems are related to the location problem and vehicle routing. Both of these problems are described as specific cases of the routing problem. And if all customers want to relate directly one warehouse the routing problem become a standard positioning problem and on the other hand if we keep the warehousing positions fixed, the problem of our routing location becomes simpler. The spatial location-routing problem, which is modeled from a mathematical perspective as a hybrid optimization problem, forms part of the dispersal management practice [10].

Policy making, planning, and optimal use of the machine in agriculture are fundamentally different in underdeveloped countries, and the need for a holistic approach in these societies is high felt, with a major emphasis on strategy and technology choice. Planning is good. In our country, of course, this has faced many ups and downs and is still far from reaching its true status. There are many and that that come from different economic ،factors social ، cultural ،technical and environmental dimensions. Any progress, solution, and planning needs to be analyzed in the current state of our country's agricultural community, because finding a solution in accordance with what has been done in developed countries does not necessarily lead to desirable results. Mechanization and use of mechanical and machine tools in agriculture are inevitable nowadays. In our country, mechanization, despite the arrival of the tractor in the forties and early forties, has not brought good results in recent decades and the objectives of the first, second and third programs have not been met [11].

Agricultural mechanization includes the production, distribution and application of all types of tools, equipment, machinery and equipment for agricultural development, crop production, and harvesting and primary crop production as defined by the FAO. New possibilities offered by mechanization to farmers such as dense cultivation, timely production processes, improved agronomic

quality, price stabilization and crop marketing such as the use of modified seeds called the Green Revolution have created a leap in agriculture. [12]

Agricultural machinery is one importance in today's world. There are many reasons why perhaps the most important are achieving better and better quality products for the multiplier population of today. So we have to be somewhat familiar with how to use them. Machines always make it easy for us to reach our work goals, such as excavators used both at planting and at harvest. At first glance, a newcomer (group members) to agricultural equipment, especially those used in excavation, may be easy tools, but seeing how they work and the power to do them and how efficient they are, will certainly change our view. We have a variety of agricultural machines that we can use in different agricultural practices in identifying land preparation machines and tuning excavators. Machine tools are used in planting, keeping and harvesting [13].

Research Methodology

The purpose of this study is to locate suitable agricultural equipment in flat and sloping land of Mahabad villages using GIS software. This research is an applied research. It is also descriptive in nature and is based on library studies. Since the findings of the research are applicable to the needs of the agricultural sector. The research can be considered as applied. One of the statistical populations of this study consists of 50 experts in the field of agronomy working in the field of agriculture and agrarian machinery. As a statistical population, these individuals were asked to answer the questions to determine the significance coefficients in the first chapter diagram. The sampling method was available as a census. All individuals are selected as the statistical sample. In this research, due to the use of spatial data obtained from GIS software, the data collection tool can be considered as spatial data bank and paired comparison questionnaire in order to determine the significance of criteria and sub-criteria. In this study, hierarchical analysis approach using spatial data was used.

For pairwise comparisons, we use Expert Choice 11 software. To do this the data were interred into the software and then was analyzed each of the available options according to the criteria selected. This is done by pairwise comparisons between decision elements (pairwise comparison) and by assigning numerical privileges that indicate the preference or importance between two decision elements. This is usually done by comparing options with the i-indexes against the j-options or the j-indexes shown in the following table how to evaluate the indexes with each other.

The following table the values of (c) will be listed as pre-selection options according to a criterion. The values of (a) will be compared as the preference coefficient of one option over the other. The values of (w) represent the relative weight of the options according to the criteria. It should be noted that in order to evaluate the judgment made, the compatibility rate should be used. If this value is less than 0.1 it is the rate of consistency and if it is greater than 0.1 it is referred to as the rate of inconsistency of judgment. Too much of this value means rejecting judgment.

Table 1: Pairwise comparisons matrix xi

	C1	C2	C3	C4	C5	C6	wi
C1	1	a_{12}	a_{13}	a_{14}	a_{15}	a_{16}	W1
C2		1	a_{23}	a_{24}	a_{25}	a_{26}	W2
C3			1	a_{34}	a_{35}	a_{36}	W3
C4				1	a_{45}	a_{46}	W4
C5					1	a_{56}	W5
C6						1	W6
Ultimate weight	0<wi<1		incompatibility rate		Cr<0/1		

Determination of significance coefficients according to the characteristics of cultivated lands

Based on the findings of the study and the results of the pairwise comparisons, two alternatives are observed which the most important factor in selecting agricultural equipment is. The relative weight index for this criterion is 0.399 which is larger than the other criteria. After this factor, soil type material is the most important factors. Finally, land elevation factor can also be considered as the weakest criterion. The inconsistency rate is lower than the estimated value of 0.1 indicating that the judgment has been made correctly. (Table .2)

Table 2. Paired Comparison Matrix by Land Characteristics

Factor	C1	C2	C3	wi
Tilt the ground	1	1.11	1.48	0.399
Type and of soil		1	1.30	0.347
Height of lands			1	0.254
Ultimate weight		incompatibility rate		0.00004

Bar chart 1: Significance coefficients according to the characteristics of the cultivated lands

Determination of significance coefficients in terms of characteristics of agricultural practices

Based on the findings of the research and the results of the comparisons of the two options, it is observed that maneuverability of agricultural equipment is the most important factor in selecting agricultural equipment and proportional to land and land in terms of agricultural characteristics. The relative weight index for this criterion is 0.281 which is larger than the other criteria. After all, the price of machine and equipment is an important factor. Paying attention to the power factor of is the third priority and then it should pay attention to the maintenance cost factor. (Table .3)

Table 3: Pairwise comparisons matrix according to the characteristics of agricultural practices

Factor	C1	C2	C3	C4	w_i
The power of agricultural equipment	**1**	**1.16**	**1.17**	**1.11**	**0.236**
Maneuverability of the equipment		**1**	**1.07**	**1.38**	**0.281**
The purchasing power of farmers			**1**	**1.15**	**0.263**
Equipment maintenance costs				**1**	**0.220**
Ultimate weight	**incompatibility rate**				**0.00005**

Bar graph 2: Significance coefficients in terms of characteristics of agricultural practices

Paired comparisons of the efficiency of agricultural equipment in terms of machine power

Based on the results of the research and the results of a comparison of the two options, observed that the efficiency of agricultural equipment in terms of machine power (output power of agricultural equipment) ITM399 tractor option is first and tractor ITM751 option is second Given that the inconsistency rate is less than 0.1, respondents judged the options correctly. In the field of comparing reapers to the power of machines (output power of agricultural equipment) the dr4w reaper is selected. In the field of combine picking, the CLAAS will be selected over the combiner j. (Table.4)

Table 4: Comparison matrix of agricultural equipment performance on machine power

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	w_i
U650	1	1.7	1.3	2.1	1.8	1.25	1.25	1.1	1.11	1.42	0.079
ITM751		1	2.46	1.2	1.18	2.46	2.25	1.87	1.61	1.47	0.132
ITM285			1	1.63	1.35	2.16	2.1	1.25	1.21	1.41	0.129
ITM399				1	1.25	2.57	2.57	2.12	2.1	3.1	0.163
ITM299					1	2.37	2.37	1.75	1.72	2.71	0.148
Tr g						1	1.25	1.14	1.25	1.45	0.067
Dr 3w							1	1.33	1.49	1.65	0.063
Dr 4w								1	1.25	1.33	0.077
combc									1	1.34	0.085
combj										1	0.056
Ultimate weight	0<wi<1		incompatibility rate		Cr<0/1						0.008

Bar graph 3: Important coefficients of efficiency of agricultural equipment on machine power

Paired Comparison of Agricultural Equipment Performance Based on Equipment Maneuverability

Based on the research findings and the results of a comparison of the two options, the efficiency of agricultural equipment in terms of maneuverability of the equipment (ability to work in different lands and areas) is the ITM399 tractor is the first option and the ITM299 tractor is second option. Other options are also coming down the line of importance. Given that the inconsistency rate is less than 0.1, respondents judged the options correctly. Dr3w is selected for comparing John Deer based on the maneuverability of the equipment (ability to work in different lands and areas). In the field of selection of combine John Deer combine 955&1055 will be selected from the CLAAS combine. (Table .5)

Table 5: Agricultural Equipment Performance Comparison Matrix by Equipment Maneuverability

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	w_i
U650	1	1.25	1.13	1.25	1.25	1.6	1.5	1.87	2.14	1.5	0.065
ITM751		1	2.1	1.9	1.19	1.12	1.25	1.9	1.43	1.25	0.113
ITM285			1	1.62	1.51	2.45	1.1	1.22	1.29	1.1	0.130
ITM399				1	1.09	1.75	1.1	1.41	1.14	1.3	0.161
ITM299					1	1.33	1.33	1.51	1.25	1.33	0.145
Tr g						1	1.74	1.35	1.65	1.1	0.043
Dr 3w							1	1.25	1.25	1.14	0.094
Dr 4w								1	1.5	1.25	0.083
combc									1	1.23	0.069
combj										1	0.098
Ultimate weight	0<wi<1		incompatibility rate		Cr<0/1						0.00103

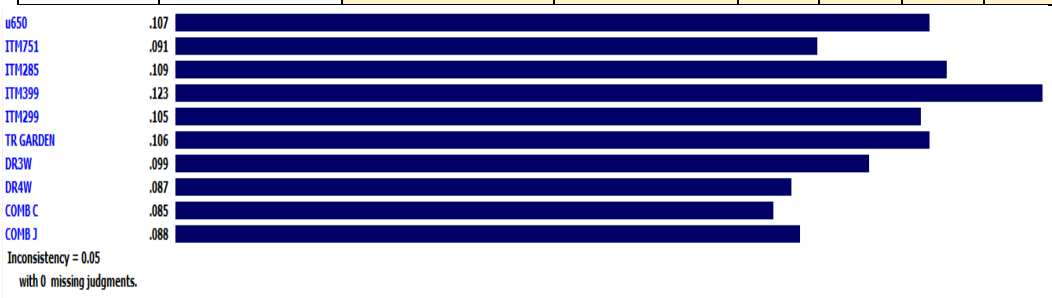
Bar Chart 4: important Factors of Agricultural Equipment Performance in terms of Equipment Maneuverability

Based on the research findings and the results of the comparison of the two options, it is observed that the efficiency of agricultural equipment in terms of land slope (sloping land versus flat land) is the ITM399 tractor is the first option and the ITM285 tractor option is the second priority. The options are also next in terms of importance. Given that the inconsistency rate is less than 0.1, respondents judged the options correctly. In order to compare the reapers based on the slope of the ground (slope to flat ground) the dr3w reaper is selected. In the field of combine picking, the John Deer combine will be selected over the CLAAS combine. (Table .6)

Paired Comparison of Farm Equipment Performance by Land Slope

Table 6: Paired Comparison Matrix of Agricultural Equipment Performance by Land Slope

instruments	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	w_i
U650	1	1.69	2.0	1.95	1.18	1.65	2.35	2.53	1.33	1.88	0.107
ITM751		1	2.2	1.52	1.39	1.43	1.78	1.15	1.25	1.33	0.091
ITM285			1	2.26	1.45	1.69	1.15	1.58	1.55	1.23	0.109
ITM399				1	1.18	1.2	1.22	1.16	1.12	1.21	0.123
ITM299					1	1.24	1.29	1.14	1.2	1.35	0.105
Tr g						1	1.4	1.22	1.36	1.29	0.106
Dr 3w							1	1.23	1.19	1.51	0.099
Dr 4w								1	1.23	1.44	0.087
combc									1	1.44	0.085
combj										1	0.088
Ultimate weight	0<wi<1		incompatibility rate		Cr<0/1						0.06



Bar chart 5: Important coefficients of efficiency of agricultural equipment in terms of land slope

Paired Comparison of Agricultural Equipment Performance by Soil Type

Based on the results of the research and the results of the comparison of two options, it is observed that the efficiency of agricultural equipment in terms of soil type (soil type) tractor ITM285 option is the first and tractor ITM751 option is the second priority. Importance is in the following ranks. Given that the inconsistency rate is less than 0.1, respondents judged the options correctly. In order to compare the reapers according to the soil type (soil type) the dr3w reaper is selected. In the field of selection of combine John Deer 955&1055 will be selected. (Table.7)

Table 7: Comparison matrix of agricultural equipment performance by soil type

instruments	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	w_i
U650	1	1.69	2.0	1.95	1.18	1.65	2.35	2.53	1.33	1.88	0.107
ITM751		1	2.2	1.52	1.39	1.43	1.78	1.15	1.25	1.33	0.091
ITM285			1	2.26	1.45	1.69	1.15	1.58	1.55	1.23	0.109
ITM399				1	1.18	1.2	1.22	1.16	1.12	1.21	0.123
ITM299					1	1.24	1.29	1.14	1.2	1.35	0.105
Tr g						1	1.4	1.22	1.36	1.29	0.106
Dr 3w							1	1.23	1.19	1.51	0.099
Dr 4w								1	1.23	1.44	0.087
combc									1	1.44	0.085
combj										1	0.088
Ultimate weight	0<wi<1		incompatibility rate		Cr<0/1						0.06

Bar Chart 6: Importance coefficients of agricultural equipment efficiency by soil type

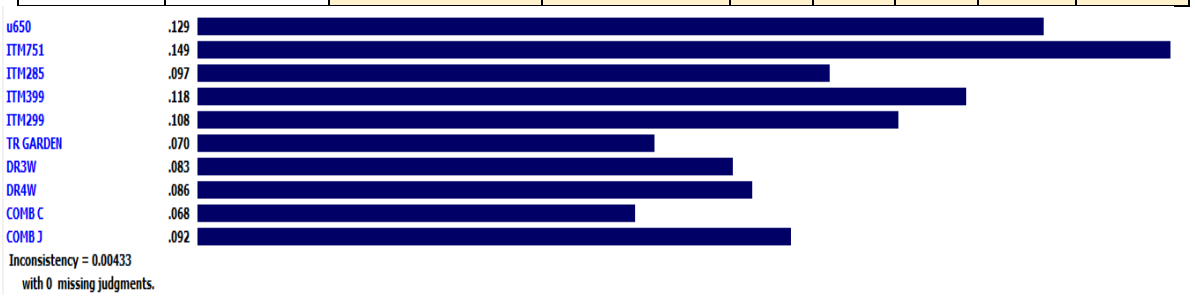
Paired Comparison of Agricultural Equipment Performance by Land Elevation

Based on the results of the research and the results of a comparison of the two options, it is observed that the efficiency of agricultural equipment in terms of land height (elevation) ITM751 tractor is the first option and u650 tractor option is the first the second priority. Subsequently, they are of importance as well. Given that the inconsistency rate is less than 0.1, respondents judged the options correctly. For comparing reapers according to the land height (elevation) the dr3w reaper is selected. In the field of selection of combine John Deere will be selected. (Table .8)

Table 8: Comparison Matrix of Agricultural Equipment Performance by Land Elevation

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	w_i
U650	1	1.27	1.56	1.27	1.4	1.56	1.4	1.75	1.4	1.4	0.129
ITM751		1	1.13	1.14	1.19	1.15	1.13	1.22	1.54	1.13	0.149
ITM285			1	1.05	1.04	1.13	1.27	1.18	1.98	1.14	0.097
ITM399				1	1.38	1.22	1.12	1.12	1.49	1.19	0.118
ITM299					1	1.37	1.32	1.28	1.29	1.41	0.108

Tr g						1	1.26	1.1	1.35	1.18	0.070
Dr 3w							1	1.2	1.24	1.49	0.083
Dr 4w								1	1.31	1.06	0.086
combc									1	1.16	0.068
combj										1	0.092
Ultimate weight	0<wi<1		incompatibility rate		Cr<0/1						0.009

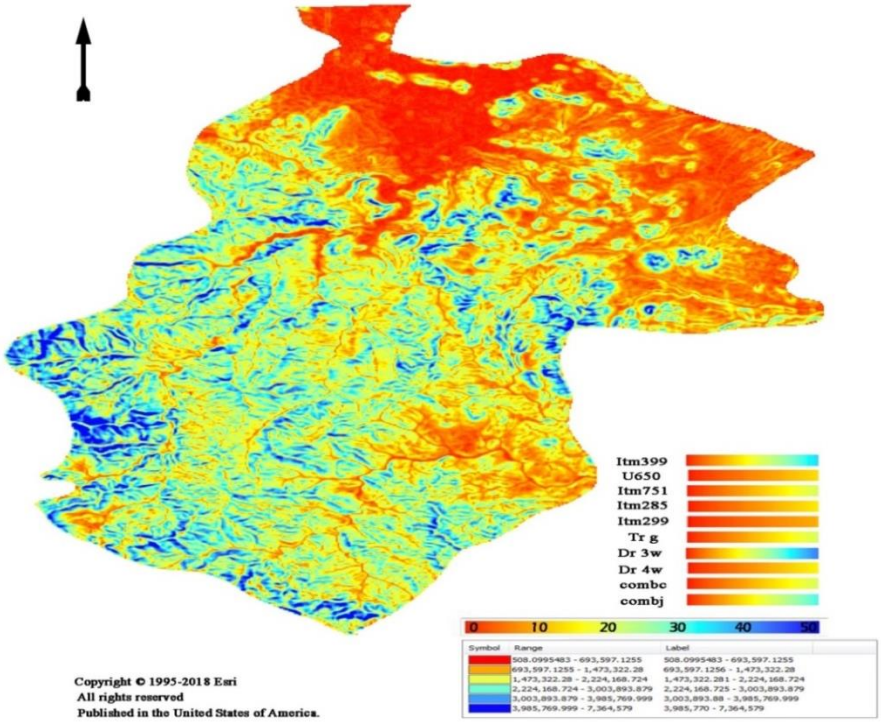


Bar chart 7: Importance coefficients of agricultural equipment efficiency by soil type

Equipment allocation by machine and slope area

According to the paired comparison results and considering the relative importance coefficients and relative weights of the investigated devices, it can be automated by entering the above information into the soft (Arc GIS) and obtaining the spatial information of the desired range. The analysis and relevancy of the equipment and location will be determined.

Picture 1. Extraction map of Mahabad city

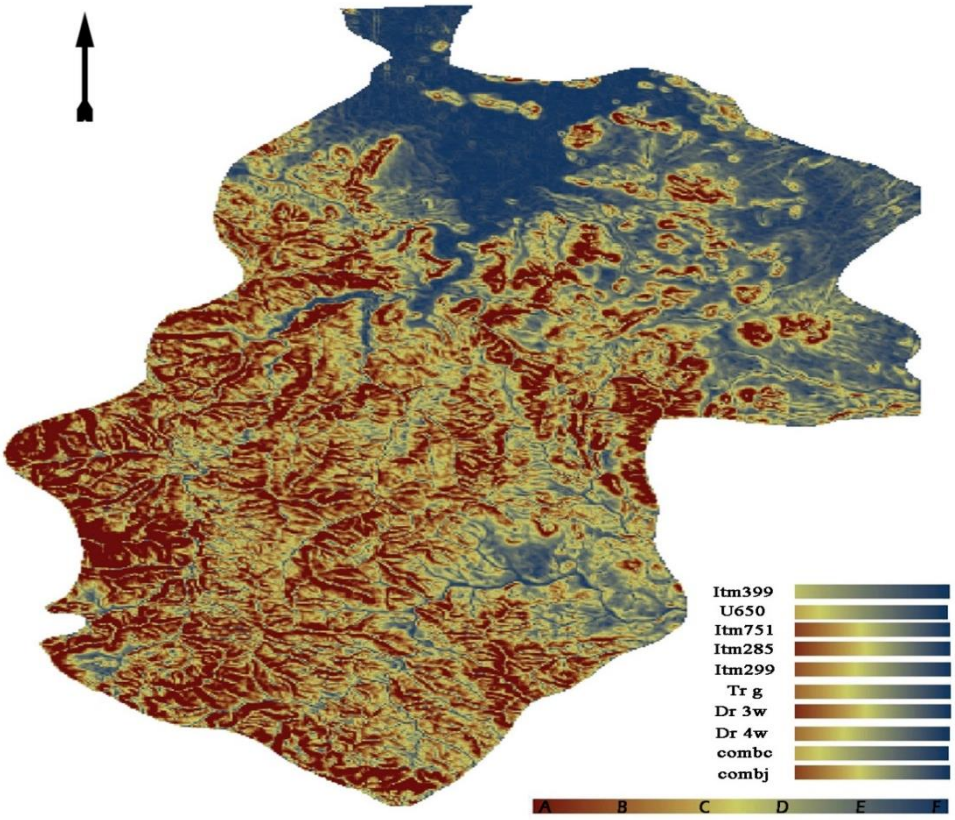


As shown in the extraction map, the differences in the surveyed equipment are shown in terms of usable locations. The picture (1) shows the range which device can be used. Also noticeable point is the overlap of some devices in the flat space, marked by the spectrum of red to orange. The map shows the area of Mahabad. Locations marked with dark blue indicate the inability

y of machinery to work in agriculture. Dots marked red to yellow indicate the ability of the equipment in that area. The point to note is the garden tractor can be used everywhere but will not be used on a comparative basis. The ITM399 tractor is capable of working in high altitudes as well as in flat terrain. It should be noted that it is not maneuverable and dimensionally capable of working in the field.

Allocation of equipment by machine and soil type

The following map is extracted based on soil zoning and agricultural equipment capability. Based on the map below, machines can be used in arable lands. In terms of soil type, soil softness factors, proximity to water channels and creeks, pits, meadows, sandy and rocky base mountains, loose soil and marshy areas are considered**.**



Picture 2. extracted based on soil zoning and agricultural equipment capability

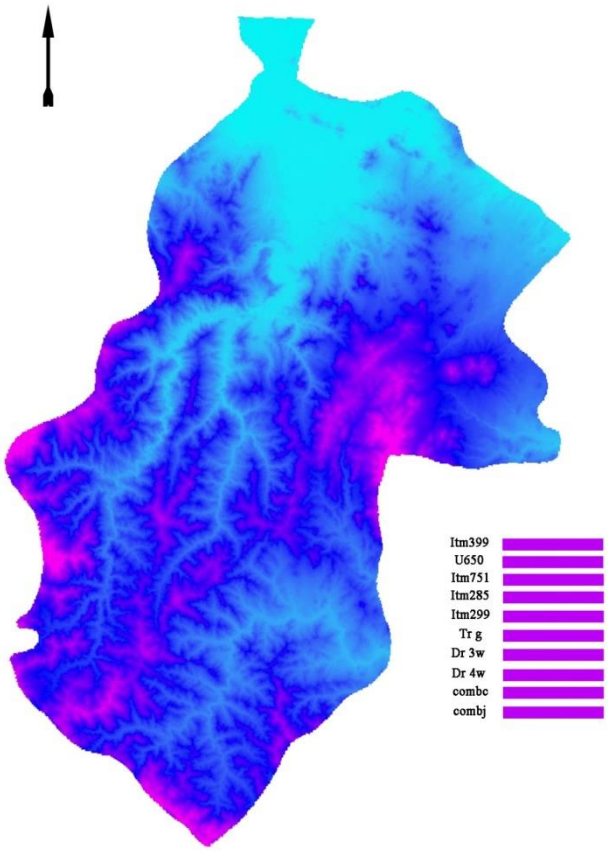
Based on the combined findings of soil type and machine type, it can be claimed that none of the tonal devices are used in dark brown zones (A). At these levels, it is impossible to operate the equipment due to the rocky terrain. At its most optimistic, tractors of the ITM751 and ITM285 type can operate in areas close to (B). Due to the fact that Mahabad area does not have marshy zones, the green color spectrum does not appear in these zones. It is possible to use ITM751 tractor in zones near soil (C). On tractors (D) to (F) other tractors can operate. ITM751 and ITM285 tractors work in almost all arable areas

John Deere combine can operate on earth (C) to (F) zones. However, it can be somewhat close to zone (B). The Combiner John Deer can operate on earth (D) to (F) zones. In these zones the efficiency of this type of combine is better.

Three-wheeled harvester can operate on earth (B) to (F) zones. This is because of the lightness and power of the maneuver. However, depending on the ambient conditions, they can operate somewhat beyond the specified range (optimistically). Due to the lower maneuverability, four-wheel reapers can operate in a shorter interval.

Equipment allocation by machine and height of land

In many cases, it has been observed that altitude affects the operation of machines. This research also deals with this factor. Given that the altitude varies with the slope, this factor is examined through the alignment map. It is to be expected that this distinction cannot be specifically distinguished. Because the high altitude, there is a limitation to be used in areas where no equipment is capable of operating in those areas. Therefore, areas where none of the devices are capable of working will be identified to combine layers to give an overview of the problem.

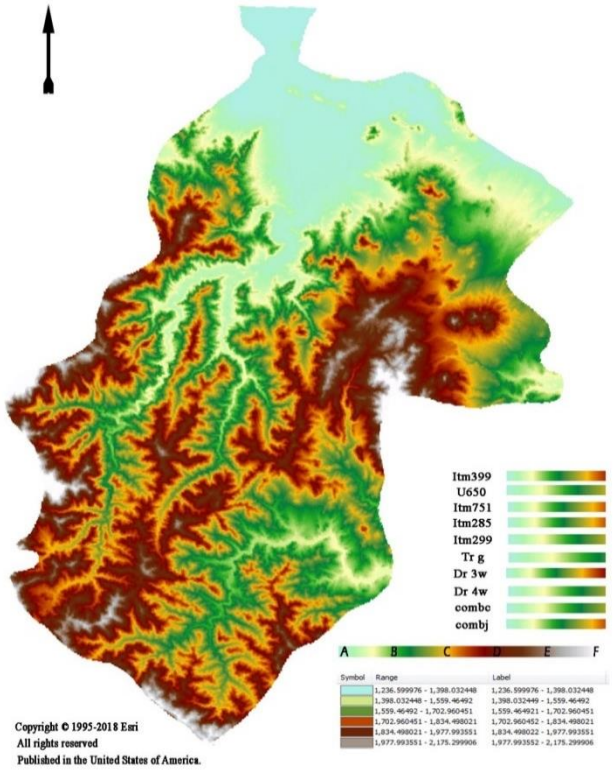


Picture 3. Extracted based on machine and height of land capability

The picture (3) shows the ability of agricultural equipment in terms of spatial variation in elevation of free water levels. Dots highlighted in purple are places where these devices are not applicable. Elevation is not an important factor in the allocation of equipment, as it is possible that there are areas with a large difference from the water level and that it may be a flat area. The map above is a combination of height and slope.

Equipment allocation based on criteria and total spatial information

In general, given the pairwise comparisons and spatial information derived from the shapes (files related to the spatial information layers retrieved by the ARC GIS software), the locations available for agricultural equipment have been identified.



Picture 4. Extracted based on based on criteria and total spatial information

Based on the extraction map (Picture 4), none of the agricultural equipment is able to be operated in the areas marked in white. Also, agricultural equipment cannot be used in areas marked with dark brown. In areas that are brownish-yellow, three-wheeled gutters can be used. This type of harvester was used between zones (C) to (D).

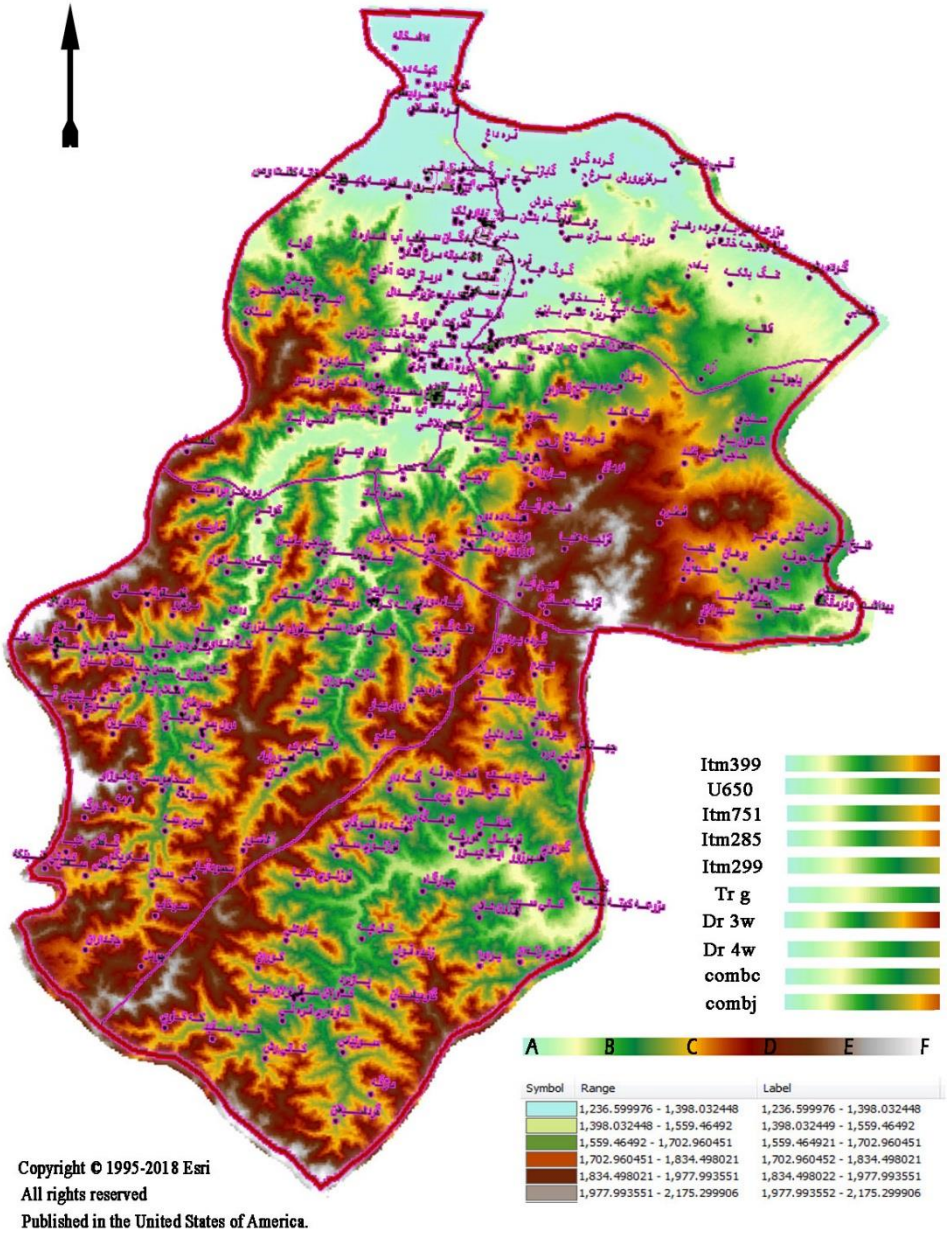
ITM399 tractor can be optimally used in the spatial (A) to (C) range. Although it can also be used in harsh conditions up to interval (D), this may not be optimal and reliable. CLAAS combinations can be used in intervals (A) to (C). However, the John Deer Combine on sloping and elevated lands can be used in zones (A) to (C) and between (C) to (D).

ITM399 and ITM399 tractors can be optimally used in the spatial (A) to (C) range. Tractors can only be used in orchards. However, depending on the power and maneuverability, it can be used in the range (A) to (C).

Locating suitable agricultural equipment at the rural level

The topographic map of the villages is shown according to location and type of agricultural equipment. According to this map, suitability of agricultural equipment is used and cultivated lands are observed**.**

Picture 5.Extracted based on suitable agricultural equipment at the rural level



Based on the map (picture 5), it is possible to determine which agricultural equipment should be used in the village and village.

3. Conclusion

Based on the findings of the research and the results of the pairwise comparisons, two alternatives are observed which is the most important factor to selecting agricultural equipment on land slope characteristics. The results of a pairwise comparison of the two options can be seen, which is the most important factor in the selection of agricultural equipment and its suitability for land depending on the characteristics of agricultural equipment. In terms of efficiency of agricultural equipment in terms of machine power (output power of agricultural equipment) the ITM399 tractor option is the first and the tractor ITM751 option is the second priority. In the field of comparing reapers to the power of machines (output power of agricultural equipment) the dr4w reaper is selected. In the field of combine picking, CLAAS is preferred to combiner.

In terms of farm equipment efficiency, in terms of equipment maneuverability (ability to work in different lands and areas), the ITM399 tractor option is the first and the ITM299 tractor option is the second priority. Dr3w is selected for comparing John Deere based on the maneuverability of the equipment (ability to work in different lands and

areas). In the field of selection of combine John Deer will be preferred to select from the CLAAS combine. In terms of efficiency of agricultural equipment, in terms of purchasing power, the tractor option U650 is the first and the tractor ITM285 is the second priority. For the purpose of comparing to compare harvests based on the purchasing power of the harvester, dr3w has been selected. In the field of selection of combine John Deer will be preferred to CLAAS combine.

In terms of efficiency of agricultural equipment, in terms of maintenance costs, the tractor horticulture option is the first and the ITM299 option is the second priority. Other options are also of importance. For comparison of reapers based on maintenance cost of dr3w reaper is selected. In the field of selection of combine John Deer will be preferred the CLAAS combine. In terms of efficiency of agricultural equipment in terms of land slope (sloping relative to flat land), the ITM399 tractor option is the first and the tractor ITM285 option is the second priority. In order to compare the reapers based on the slope of the ground (slope to flat ground) the dr3w reaper is selected. In the field of combine picking, the John Deer combine will be selected over the CLAAS combine. In terms of efficiency of agricultural equipment by soil type (soil type), the ITM285 tractor option is the first and the tractor ITM751 option is the second priority. In order to compare the reapers according to the soil type (soil type) the DR3W reaper is selected. In the field of selection of combine John Deere will be selected from the CLAAS combine.

In terms of efficiency of agricultural equipment in terms of land height (elevation) ITM751 tractor option comes first and tractor option U650 is second priority. In the field of comparison of reapers according to the land height (height of free water surface) the dr3w reaper is selected. In the field of selection of combine John Deere 5 will be selected from the CLAAS combine.

Based on the combined findings of soil type and machine type, it can be claimed that none of the tonal devices are used in dark brown zones (A). At these levels, it is impossible to operate the equipment due to the rocky terrain. At its most optimistic, tractors of the ITM751 and ITM285 type can operate in areas close to (B). Due to the fact that Mahabad area does not have marshy zones, the green color spectrum does not appear in these zones. It is possible to use ITM751 tractor in zones near soil (C). On tractors (D) to (F) other tractors can operate. ITM751 and ITM285 tractors work in almost all arable areas.

John Deer combine can operate on earth (C) to (F) zones. However, it can be somewhat close to zone (B). The Combiner John Deer can operate on earth (D) to (F) zones. In these zones the efficiency of this type of combine is better. Three-wheeled harvester can operate on earth (B) to (F) zones. This is because of the lightness and power of the maneuver. However, depending on the ambient conditions, they can operate somewhat beyond the specified range (optimistically). Due to the lower maneuverability, four-wheel reapers can operate in a shorter interval. ITM399 tractor can be optimally used in the spatial (A) to (C) range. Although it can also be used in harsh conditions up to interval (D), this may not be optimal and reliable. CLAAS combinations can be used in intervals (A) to (C). However, the John Deere Combine on sloping and elevated lands can be used in zones (A) to (C) and between (C) to (D). ITM399 and ITM399 tractors can be optimally used in the spatial (A) to (C) range. Tractors can only be used in orchards. However, depending on the power and maneuverability it can be used in the range (A) to (C).

It is recommended that the agricultural organization in Iran and other relevant agencies provide information based on the results of the research and inform the farmers by providing them with through providing appropriate brochures and catalogs when purchasing agricultural equipment.

It is recommended to train farmers publicly to help them choose the right agricultural tool and training at Agricultural Centers to educate the public on how to purchase agricultural equipment.

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