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Cereal Crop Farm Planning for Profit Maximization in Afghanistan

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Cereal crops are the major component of agriculture sector in Afghanistan by generating income and providing food dietary of subsistence to the farm family. The sector which is dominated by small scale farmer across the country is facing numerous problems such as inefficient use of resources, poor production technology, low labor productivity and high production costs. This study was carried out to maximize farm income by optimization resource allocation and developing an optimal farm plan for a cooperative farm in Ahmad Abad district. A field survey was conducted to collect primary input–output oriented data from 32 cooperative farmers. Linear programming techniques was employed to optimize resources allocation, maximizing economic return restricted by certain linear constraints including land, irrigation water, production cost, human labor, tractor power and subsistence food requirement. The result suggested to allocates 179.20, 11.80, 9.97 and 4.92 hectares to wheat, maize, rice and barley, respectively. While, farmers allocate 72.0, 57.9, 36.9 and 39.1 hectares to wheat, maize, rice and barley, respectively. Following, which the gross revenue increases from 3,275,986 AFs in the actual plan to 4,518,906 AFs in the optimal plan (Indicating a 37.9% improvement). Results indicating that the existing plan of farmers is not efficient in term of resource allocation and economic outcome. Furthermore, the optimal plan argued the employment activities of the farm. The result reveal that hiring of labor is not required, even in the activities peak season (May, June and August). Eventually, the optimal plan enables 13.5% saving in the labor time. Furthermore, by efficient resource allocation only land is a binding constraint, capital, irrigation water and tractor do not limit the production process. Ultimately wheat came up as the most profitable crop of farm, farmers should allocate more arable land to wheat cultivation, which will enable the economic position of farm to be more sustainable and commercial.

Key words: Afghanistan, Cereal crop, Linear programming, Resource optimization

INTRODUCTION

Afghanistan is an Agricultural country, 80 percent Afghan population earns its livelihood from agricultural activities, the national economy is based on agriculture which contributes about 31% of Afghanistan’s legitimate gross domestic product (Sarwary, 2011). Cereal crops are the major agricultural products and primary source of consumption and income generation playing a crucial role in the food security and poverty alleviation of the country. Scarcity of resource has characterized grain production in the study area, where farming activities face various obstacles, such as limited availability of capital, arable land, labor, irrigation water and subsistence food requirement. Furthermore, problems associated with inefficient resource utilization are not only limited to the farm but also lead to environmental degradation restricting sustainable agricultural development and social welfare of the country.

In the operational level, since access to the technical decision–making frameworks is limited, producers cannot decide on an optimal production line to achieve a major or overall aim of the farm. Scientific techniques can provide useful and precise agricultural information which is a basic requirement for formulating import–export policies, pricing strategy, planning agriculture development and tackling other relevant issues (Ashourloo et al., 2008). Also, a technical resolution enables producers to adjust themselves with the rapidly changing technology, governmental policies, and market requirements. Given the dynamic nature of agricultural production, farmers do not have answers to some of the management–related questions. The conditions in which farmers operate lead to considerable complexity and question such as how to organize production plans to achieve a better outcomes or economically efficient production are a continuous focus of research in the farm management (Ivana et al., 2012).

Linear programming (LP) is the most widely used mathematical technique for the analysis of economic problems in agriculture and other aspects of life (Oni et al., 2013). Afghans witnessed several studies during the last one and half decade employed through various organizational programs such as Food and Agricultural Organization (FAO), World Bank, World Food Program (WFP), US Agency for International Development (USAID), International Fund for Agriculture development (IFAD), Comprehensive Agriculture and Rural Development–Facility (CARD–F) and Japan International Cooperation Agency (JICA). Majority of these studies are devoted to food security, poverty alleviation and business opportunities, most of which is carried out on national and policy level. Furthermore, none of the conducted studies employ mathematical techniques; except

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Reeling et al. (2012), who conducted a study titled “Policy Options to Enhance Agricultural Irrigation in Afghanistan” using linear programming approach.

Since farm-based study can help farmers in efficient resource allocation and there is little study on crop planning in Afghanistan’s agriculture literature. Therefore, this study aims to determine the optimal farm plan for major grain products, using linear programming approach, to ensure maximum gross margin to the farm, subject to certain linear constraints.

**METHODOLOGY**

**Data collection and analytical techniques:**

The study is sited in Ahmad Abad district of Paktia-Afghanistan, located in the southeast of the country. The study area is plain and has cold winters and typically hot summers, because of the long winter season and cold weather, only one-season crops can be produced. Cereal crop farming activities begin in May and end in December which cultivated season of all the crops overlap each other. For this study, four major cereal crops are selected: wheat, maize, rice and barley. Majority wheat varieties are sown in the autumn and harvested in the summer season, the other crops are spring seeded.

Survey for data collection was conducted in 2014. A two stages sampling method was used to collect primary data. In the first stage, one district is selected purposely. Ahmad Abad district has a wide area of cultivation and adjoining to the provincial market. In the second stage, a cooperative farming site is selected based on farming type, farm size and soil conditions covering two villages of Zandi Khail and Salam Khail. Farmers of the study area are engaged cooperatively in grain production and operate under the one administrative unit (Gharak Agriculture Cooperative). Therefore, subject of the model is aggregate profit maximization of a cooperative farm subject to the certain linear constraints. Because of the assumption of certainty, yield of products, price of output and production cost are assumed to be certain. Using a semi-structured questionnaire, 32 farmers were asked to collect input/output-oriented data.

Two types of activities are incorporated in the study model: land allocation and assessing of hired labor requirement. Available land can be devoted to two types of enterprises: sole crop and crop mixture. Despite, labor is not limiting the production process overall the year, occasionally in the activities peak-season is bound to limit the process and farmers find themselves imposed on hiring labor. Therefore, four additional decision variables are introduced into the model, to assess whether the hiring of labor is needed or not.

The General Algorithm Modeling System (GAMS) optimization tool is preferred to analyze the optimality of resources. A deterministic linear programming model is selected to find out the optimal farm plan increasing the gross revenue of firm subject to cultivation land, working capital, irrigation water, labor force, tractor time and minimum production requirement. Linear programming is a decision-support tool optimizing limited resource utilization; the adjective “linear” is employed to show a direct relationship and “programming” denotes the use of certain mathematical methods to find out an efficient solution to a problem involving limited resources (Ahmed, Jamalludin and Saidatulakmal, 2011a). The general structure of the model (Igwe and Onyenweaku, 2013a) is as follows:

Maximize 
\[ Z = \sum_{i=1}^{n} P_i X_i - \sum_{i=1}^{n} \sum_{j=1}^{m} C_{ij} X_{ij} \]  
\[ (1) \]

Subject to:
\[ \sum_{i=1}^{n} a_{ij} X_i \leq b_i \]  
\[ (2) \]
\[ \sum_{i=1}^{n} f_{ij} X_i \geq F_i \]  
\[ (3) \]
\[ X_j \geq 0 \]  
\[ (4) \]

**Notations:**

“Z” is indicating the gross margin of the farm. “P_i” is the price of resource “i” and “C_{ij}” is the cost per unit of input “i” for the production activity “j”. “a_{ij}” denotes the amount of resource “i” required for the production of one

<table>
<thead>
<tr>
<th>Activity</th>
<th>Wheat</th>
<th>Maize</th>
<th>Rice</th>
<th>Barley</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Revenue (Af)</td>
<td>23405.60</td>
<td>6746.10</td>
<td>17612.00</td>
<td>14074.20</td>
<td></td>
</tr>
<tr>
<td>Cultivable Land (Ha)</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>( \leq 205.90 )</td>
</tr>
<tr>
<td>Operating Cost (Af)</td>
<td>65103.40</td>
<td>52051.10</td>
<td>63648.00</td>
<td>48736.40</td>
<td>( \leq 13157095.60 )</td>
</tr>
<tr>
<td>Irrigation Water (m^3)</td>
<td>5315.10</td>
<td>11994.80</td>
<td>26078.90</td>
<td>3450.00</td>
<td>( \leq 3284750.00 )</td>
</tr>
<tr>
<td>Labor force (hr)</td>
<td>236.00</td>
<td>259.00</td>
<td>435.00</td>
<td>283.00</td>
<td>( \leq 298885.20 )</td>
</tr>
<tr>
<td>Tractor time (hr)</td>
<td>99.70</td>
<td>90.60</td>
<td>68.20</td>
<td>65.00</td>
<td>( \leq 64120.00 )</td>
</tr>
<tr>
<td>Wheat M.req (ton)</td>
<td>3.62</td>
<td></td>
<td></td>
<td></td>
<td>( \geq 59.70 )</td>
</tr>
<tr>
<td>Maize M.req (ton)</td>
<td>3.22</td>
<td></td>
<td></td>
<td></td>
<td>( \geq 38.00 )</td>
</tr>
<tr>
<td>Rice M.req (ton)</td>
<td>3.40</td>
<td></td>
<td></td>
<td></td>
<td>( \geq 33.90 )</td>
</tr>
<tr>
<td>Barley M.req (ton)</td>
<td>2.92</td>
<td></td>
<td></td>
<td></td>
<td>( \geq 14.40 )</td>
</tr>
</tbody>
</table>

unit of “j”. “Xi” indicates the required quantity of input “i” for the production of activity “j” and “F,” is the annual family minimum production requirement in tons.

Equation (1) shows the objective function of the study model, which aims to find cropping pattern maximizing total gross margin Z. Equation (2) shows the amount of required and available resources (e.g., land, irrigation water, labor, tractor, and subsistence food requirement). Equation (3) indicates the minimum grain production (wheat, maize, rice and barley) to be produced for food dietary subsistence. Equation (4) declares the non–negativity constraints, indicating that all inputs used in cereal crop production and its output should be zero or greater than zero. Table 1 shows the important coefficients used in this study.

RESULT AND DISCUSSION

Table 2 showed the optimum cropping pattern, prescribes a crop mixture, comprising 179.20, 11.81, 9.96 and 4.92 hectares of wheat, maize, rice and barley respectively, which follow gross revenue 4,518,906 AFs against 3,275,986 AFs in the existing plan (indicating a 37.9% improvement). The result suggests that the optimal plan is different from the actual plan of the farm, concerning cropping pattern, economic return and resource allocation. Distribution of crops area within the farming system is usually determined by several factors, the market–oriented factors are utmost of the importance (Ahmed, Jamalludin and Saidatulakmal, 2011c). Precisely, the variation between the actual and optimum plan concerns the disparity in input–output price (market–oriented factors), yield and production cost of the products. Moreover, the discrepancy of results is ascribable to the data of yield and price, which are used without deliberating uncertainty associated with the data. The optimal pattern, regardless of risk and unreliability factors, allocates most of the land and other resources to the cultivation of most profitable crop, this marks the difference between the actual and optimal income of the operators (Piri et al., 2011a).

In the optimal solution, wheat is in the best competitive position and is considered as the most profitable activity of the farm. Thus, most of the available land area (87.03%) is recommended for wheat cultivation. This finding is consistent with that of Ahmed, Jamalludin and Saidatulakmal (2011d), which allocates 25% of the total available land area to the wheat cultivation, followed by 19, 14 and 1% to sorghum, onion and potato, respectively. The possible reasons for this affirmation are the high gross margin, increasing market demand, and consumption of wheat as a staple crop in Afghan community. Wheat provides just slightly less than 60% of total calories to the diet on average, while rice and maize jointly supply only 11 percent (Food Security Response Analysis Support Team Afghanistan, 2013). Therefore, the annual financial contribution of wheat to the objective function is higher in comparison to that of other cereal crops. Furthermore, wheat utilizes less input more efficiently with higher output (Piri et al., 2011b). For maize, rice and barley parcel of land is devoted satisfying family food consumption. The “Allowable Increasing/Decreasing in Price” columns provide further information about the optimality range of gross revenue. Current gross receipts from wheat are 23,405.6 AFs per hectare. The increasing price of wheat will not alter the optimal solution. Decreasing gross margin more than 5, 793.6 AFs per hectare will change the optimal solution. It shows better flexibility level for wheat in comparison to that of all of other crops.

In addition to the land allocation, the optimal plan encircles the employment activities of the farm. Table 2 clarifies that hiring of labor is not demanded in May, June, July, and August “Optimal Value Column”. Moreover, the “Reduced Cost” column shows the effects of excluded activities on the value of objective function. Hiring one unit of labor will decrease the gross revenue by 24.4 AFs. In order to reduce cost production, farmers usually avoid hiring of labor. However, occasionally and for some labor–intensive activities, farmers found themselves compelled to employ farm labor (Ahmed, Jamalludin and Saidatulakmal, 2011c).

Moreover, the existing plan tends to be less market-oriented than the optimal plan of the farm. The result

<table>
<thead>
<tr>
<th>Decision Variable</th>
<th>Unit</th>
<th>Optimal Value</th>
<th>Allowable Increase/Decrease in Price (AF)</th>
<th>Allowable Decrease in Price (AF)</th>
<th>Reduced Cost (AF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land allocation for wheat (X₁)</td>
<td>Ha</td>
<td>179.20</td>
<td>+∞</td>
<td>23,405.6</td>
<td>5,793.6</td>
</tr>
<tr>
<td>Land allocation for maize (X₂)</td>
<td>Ha</td>
<td>11.80</td>
<td>16,659.5</td>
<td>6,746.1</td>
<td>–∞</td>
</tr>
<tr>
<td>Land allocation for rice (X₃)</td>
<td>Ha</td>
<td>9.97</td>
<td>5,793.6</td>
<td>17,612</td>
<td>–∞</td>
</tr>
<tr>
<td>Land allocation for barley (X₄)</td>
<td>Ha</td>
<td>4.92</td>
<td>9,331.4</td>
<td>14,074.2</td>
<td>–∞</td>
</tr>
<tr>
<td>Hired labor in May (L₁)</td>
<td>Hr</td>
<td>0.0</td>
<td>24.4</td>
<td>–24.4</td>
<td>–∞</td>
</tr>
<tr>
<td>Hired labor in June (L₂)</td>
<td>Hr</td>
<td>0.0</td>
<td>24.4</td>
<td>–24.4</td>
<td>–∞</td>
</tr>
<tr>
<td>Hired labor in July (L₃)</td>
<td>Hr</td>
<td>0.0</td>
<td>24.4</td>
<td>–24.4</td>
<td>–∞</td>
</tr>
<tr>
<td>Hired labor in August (L₄)</td>
<td>Hr</td>
<td>0.0</td>
<td>24.4</td>
<td>–24.4</td>
<td>–∞</td>
</tr>
</tbody>
</table>

Source: Field survey, 2014, +∞= positive infinity, –∞= negative infinity, AF= Afghan currency
found a significant improvement in resource utilization, and economic benefits as a consequence of resource optimization. It shows the economic inefficiency of the existing plan, which relapses the economic position of the farm to be subsistence. The study found that the farm has more potential of improvement, the optimal plan will enhance farmers’ ability in converting traditional agriculture to that of the commercial one. Thus, for the future progress of a farming sector planning is a vital tool, otherwise guess work and experience cannot guarantee the efficient solution.

The results suggest that the proportion of land allocated to wheat has increased by 52.06%, while those allocated to maize, rice, and barley have decreased by 22.39%, 13.08, and 16.6%, respectively. Figure 1 shows wheat as the main crop of the farm, which is consistent with the real situations of the country. Wheat is a major crop in Afghanistan’s agriculture sector, accounting for roughly 70 percent of the total cultivated land area (Chabot, Philippe and Dorosh, 2007). In line with the decisions made by farmers, the significant quantitative differences of land allocation concern the fluctuations arising from the yield and price of products. Furthermore, fluctuations in weather, unstable market and political insecurity, have made wheat and other grain crop production remains highly volatile (World Bank, 2012). Risk associated with the economic benefits have lead farmers toward crop diversity and a more normal distribution of land among all the crops of farm. Figure 1 reveals wheat as the major crop in the optimal, as well as actual plans of the farm.

Table 3 presented the optimal solution for the resource allocation. The “Optimal Value” column describes how much of each resource is utilized and what quantity of the required minimum production is produced. The result shows that the existing technology and resources are not allocated efficiently, which is the main cause of low income return to the farm. All the scarce resources and activities restricting the production level are titled as a constraint of the model. In the current study, land, capital, irrigation water, labor force, tractor power and minimum production requirement are incorporated as constraints of the model. Table 3 shows that the production process is limited by some of the constraints. Total available land is 205.9 ha, all of which is allocated to crops cultivation, indicating that land is the first binding constraint. Followed by minimum production requirements of maize, rice, and barley. Minimum dietary food is just produced to meet the self-consumption requirement of subsistence farmers who are less market-oriented (Igwe and Onyenweku, 2013b). Moreover, only wheat production earns surplus revenue for the farm. Thus, although maize, rice, and barley are not market-oriented, they are listed in the food crops of the farm. Furthermore, the “Dual Price” column shows the effects of change in the amount of available resources on the value of gross margin. Producing one additional unit of maize, rice, and barley will diminish the profit by 5,173.8, 1,704.0, and 3,195.7 AFs, respectively.

Operating cost, irrigation water, labor force, and available tractor time are not binding production level and the surplus is maintained (see the “Slack” column). Therefore, producing additional units of non-binding constraints will not affect the economic returns of the farm. Working capital is not restraining production level, the available amount is 13,157,095.6 Afghani against the required optimum amount 13,156,502.07 Afghani, point out that operating cost is maintaining surplus 1,115.54 Afghani, which is not sufficient to activate an additional unit of land.

Water scarcity is the pivotal problem restricting crop production especially in hot and dry summers within arid and semiarid regions in Afghanistan (Roberto, 2010). In the study area, the annual irrigation water is estimated at 3,284,750.00 m³, and the optimum required amount is 1,372,334.60 m³, preserving 1,912,415.40 m³ as a surplus. Whereas optimal plan suggests most of the area to wheat cultivation and after barley wheat is less water intensive crop. Therefore, the optimal plan found water as a non-binding constraint of the model.

Results show that the surplus labor force exceeds those of other constraints. Labor usage differs on a monthly basis according to the minimum requirement; the largest surplus is 23,939.98 hours in March, followed by 22,809.83 hours in September. Compared to the existing plan, the total required labor has only increased for wheat farming, for the remaining activities total labor utilization has been decreasing. Eventually, the optimal solution enables 13.5% savings in the labor time. This finding is consistent with that of Igwe and Onyenweku (2013c), which suggests that labor utilization in the optimal plan were less than as obtained in the existing plan of the farm. The “Allowable Increase/Decrease” columns provide further information of shifting in the resource pattern. For all the binding constraints, assuming non-degeneracy, any change in the available amount of resource will result in a change in the model’s solution (Darko et al., 2013).

In term of the previous plan, the required production level in the optimal plan has been only extended for wheat. Thus, decreasing wheat production by 589.00 tons will not alter the optimal solution, while decreasing the production of maize, rice, and barley has been tightened and cannot be decreased beyond the range of optimality. Farming sector in Afghanistan is remaining traditional; however, recently evolving toward mechanization, currently tractor is the only machinery which is used for tillage, cultivation, harvesting, and transportation. Monthly basis tractor’s constraints are incorporated into the model,
none of which is limiting the production process.

**CONCLUSION**

This study was conducted to find an optimal plan to maximize the gross margin of the major cereal crops. The results suggest a more profitable plan than the actual plan of the farm, where profit with the optimal plan has increased by 37.9%. This indicates that there is more potential than the current decision made by farmers. The optimal solution prescribes wheat as the most profitable crop for the farm; hence, it proposes that largest part of the land, capital, labor, and other resources must be directed toward wheat cultivation. Maize, rice, and barley can only be produced for satisfying the food requirements of the farmers. The available labor, operating cost, irrigation water, and tractor time do not pose limitations to the production process. Moreover, the production process can be carried out by family labor. Therefore, hiring of additional labor is not required. Eventually, the optimal plan enables 13.5% of savings in labor time. Despite, land is limiting the production process; activation of an additional unit of land will not be sustained by the available resources.

All the circumstances for this study are assumed to be certain. Indeed, fluctuations arising from the price and yield of products can alter the optimal solution. Therefore, future studies should consider the uncertainty of the time series data using stochastic linear programming. However, it is recommended to the farmers to lead more land and others resources toward wheat cultivation. The government and non-governmental organizations should improve policies to reduce risk associated with the commercial farming, through contract farming, subsidy and market price stability.

**ACKNOWLEDGEMENT**

The authors wish to acknowledge Mr. Kaleemullah Sadiq Ahmadzai, provincial extension manager department of agriculture irrigation and livestock of Paktia, for sharing valuable information and facilitating during the field survey. Moreover, we also would like to acknowledge Mohammad Karim Ahmadzai, lecturer at the department of agricultural economics, Paktia university, for his helpful suggestions and assisting in the data collection.

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**Table 3. Optimal solution for the decision variables**

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Unit</th>
<th>Optimal Value</th>
<th>Slack or Decrease</th>
<th>Allowable Increase</th>
<th>Allowable Decrease</th>
<th>Dual Price (AF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Ha</td>
<td>205.90</td>
<td>0.0</td>
<td>0.00</td>
<td>162.71</td>
<td>23,405.60</td>
</tr>
<tr>
<td>Operating cost</td>
<td>Af</td>
<td>13,156,502.07</td>
<td>1115.54</td>
<td>+∞</td>
<td>1,115.54</td>
<td>0.0</td>
</tr>
<tr>
<td>Irrigation water</td>
<td>M3</td>
<td>1,372,334.60</td>
<td>1913627.00</td>
<td>+∞</td>
<td>1,913,627.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in March</td>
<td>Hr</td>
<td>167.5</td>
<td>23039.98</td>
<td>+∞</td>
<td>23,039.98</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in April</td>
<td>Hr</td>
<td>4,161.1</td>
<td>19940.53</td>
<td>+∞</td>
<td>19,940.53</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in May</td>
<td>Hr</td>
<td>6,175.6</td>
<td>17333.18</td>
<td>+∞</td>
<td>17,333.18</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in June</td>
<td>Hr</td>
<td>7,032.5</td>
<td>17070.32</td>
<td>+∞</td>
<td>17,070.32</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in July</td>
<td>Hr</td>
<td>9,884.8</td>
<td>14229.69</td>
<td>+∞</td>
<td>14,229.69</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in August</td>
<td>Hr</td>
<td>10,335.53</td>
<td>13773.25</td>
<td>+∞</td>
<td>13,773.25</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in September</td>
<td>Hr</td>
<td>1,306.13</td>
<td>22809.83</td>
<td>+∞</td>
<td>22,809.83</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in October</td>
<td>Hr</td>
<td>6,461.10</td>
<td>17655.48</td>
<td>+∞</td>
<td>17,655.48</td>
<td>0.0</td>
</tr>
<tr>
<td>Labor in November</td>
<td>Hr</td>
<td>5,642.57</td>
<td>18464.65</td>
<td>+∞</td>
<td>18,464.65</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in March</td>
<td>Hr</td>
<td>53.59</td>
<td>7069.69</td>
<td>+∞</td>
<td>7,069.69</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in April</td>
<td>Hr</td>
<td>1,970.03</td>
<td>5149.96</td>
<td>+∞</td>
<td>5,149.96</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in May</td>
<td>Hr</td>
<td>2,017.68</td>
<td>5104.64</td>
<td>+∞</td>
<td>5,104.64</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in June</td>
<td>Hr</td>
<td>4,313.26</td>
<td>2817.63</td>
<td>+∞</td>
<td>2,817.63</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in July</td>
<td>Hr</td>
<td>5,125.30</td>
<td>1996.41</td>
<td>+∞</td>
<td>1,996.41</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in August</td>
<td>Hr</td>
<td>445.33</td>
<td>6678.83</td>
<td>+∞</td>
<td>6,678.83</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in September</td>
<td>Hr</td>
<td>402.63</td>
<td>6723.26</td>
<td>+∞</td>
<td>6,723.26</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in October</td>
<td>Hr</td>
<td>2,903.56</td>
<td>4215.44</td>
<td>+∞</td>
<td>4,215.44</td>
<td>0.0</td>
</tr>
<tr>
<td>Tractor in November</td>
<td>Hr</td>
<td>2,706.28</td>
<td>4412.75</td>
<td>+∞</td>
<td>4,412.75</td>
<td>0.0</td>
</tr>
<tr>
<td>Wheat. M. req</td>
<td>Ton</td>
<td>645.11</td>
<td>589.00</td>
<td>589.0</td>
<td>–∞</td>
<td>0.0</td>
</tr>
<tr>
<td>Maize. M. req</td>
<td>Ton</td>
<td>38.00</td>
<td>0.0</td>
<td>523.9</td>
<td>0.03</td>
<td>–5,173.8</td>
</tr>
<tr>
<td>Rice. M. req</td>
<td>Ton</td>
<td>34.00</td>
<td>0.0</td>
<td>313.1</td>
<td>0.27</td>
<td>–1,704.0</td>
</tr>
<tr>
<td>Barley. M. req</td>
<td>Ton</td>
<td>14.00</td>
<td>0.0</td>
<td>475.1</td>
<td>0.02</td>
<td>–3,195.7</td>
</tr>
</tbody>
</table>

Source: Field survey, 2014, +∞ = positive infinity, –∞ = negative infinity, AF = Afghan currency, M. req = minimum requirement
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