Operational framework to characterize the diversity and the efficiency of farming systems in dryland areas: the case of Saïs, Morocco

El Ansari L*1,2, Belhouchette H1,3, Chenoune R3, Yigezu Y. Atnafe 4, Gary C 2

1 CIHEAM-IAMM-UMR System
2 INRA-UMR System
3 CIHEAM-IAMM
4 ICARDA

* El Ansari Loubna: elansari@iamm.fr
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Challenge of food security

Increasing agricultural production to meet food demand (Petersen et al., 2015)

Dryland areas

Environmental capital is heavily affected (Robinson et al., 2015)

Intensification with rational use of natural resources
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Sustainable use of natural resources (Garnett et al. 2013).

Characterization of current farming systems diversity, their productivity and their efficiency in the use of natural resources

Identify levers for a sustainable use of natural resources
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Materials and Method

Step 1: Characterization of farming systems based on farm clustering

Data collection for farm household composed of three components: structural, economic, and consumption data

Farm typology based on clustering analysis: Principal Component Analysis (PCA) & Hierarchical Ascendant Classification (HAC)

Step 2: Cross analysis based on farm efficiency analysis

Technical efficiency at farm scale, based on the Data Envelopment Analysis

Cross analysis depending on: Farm income inputs, energy, total inputs cost
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Results and discussion

\textbf{Step 1: Characterization of farming systems based on farm clustering}

\begin{center}
\begin{table}
<table>
<thead>
<tr>
<th>Class-typology</th>
<th>Quantity-Nitrogen (kg/ha)</th>
<th>Quantity-irrigation water (m3/ha)</th>
<th>Farm Income (dh/ha)</th>
<th>Labor (person-day/ha)</th>
<th>Total Mechanic labor (dh/ha)</th>
<th>Technical orientation Cereals (%)</th>
<th>Technical orientation Legumes (%)</th>
<th>Technical orientation Vegetables (%)</th>
<th>Off Farm income (dh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-urban system, predominantly vegetable-intensive farming</td>
<td>142.89</td>
<td>583.94</td>
<td>19985</td>
<td>56</td>
<td>671</td>
<td>11</td>
<td>2</td>
<td>87</td>
<td>3697</td>
</tr>
<tr>
<td>Cereal system - semi intensive farming</td>
<td>83.36</td>
<td>41.44</td>
<td>7379</td>
<td>15</td>
<td>768</td>
<td>95</td>
<td>2</td>
<td>3</td>
<td>3628</td>
</tr>
<tr>
<td>Conventional system - Cereals &amp; legumes - extensive farming</td>
<td>60.96</td>
<td>6.93</td>
<td>6492</td>
<td>11</td>
<td>585</td>
<td>47</td>
<td>56</td>
<td>1</td>
<td>2458</td>
</tr>
</tbody>
</table>
\end{table}
\end{center}

\textbf{Fig. 1}: Distribution of farms surveyed (n = 287) by classes of farms as a function of PC1 and PC2.
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Results and discussion

Step 2: Cross analysis based on farm efficiency analysis

- **Mixed cereals/vegetables farming systems**: the most efficient in term of farm income, inputs use, and energy;

- **Single vegetables farming systems**: the least efficient and performing systems;

- **Mixed cereals/legumes/vegetables farming systems**: the intermediate systems which can improve efficiencies and farm income.

**Fig.2**: Cross analysis of farming systems, based on farm efficiency analysis- Peri-urban system, Predominantly vegetable- intensive farming
Thank you for your attention