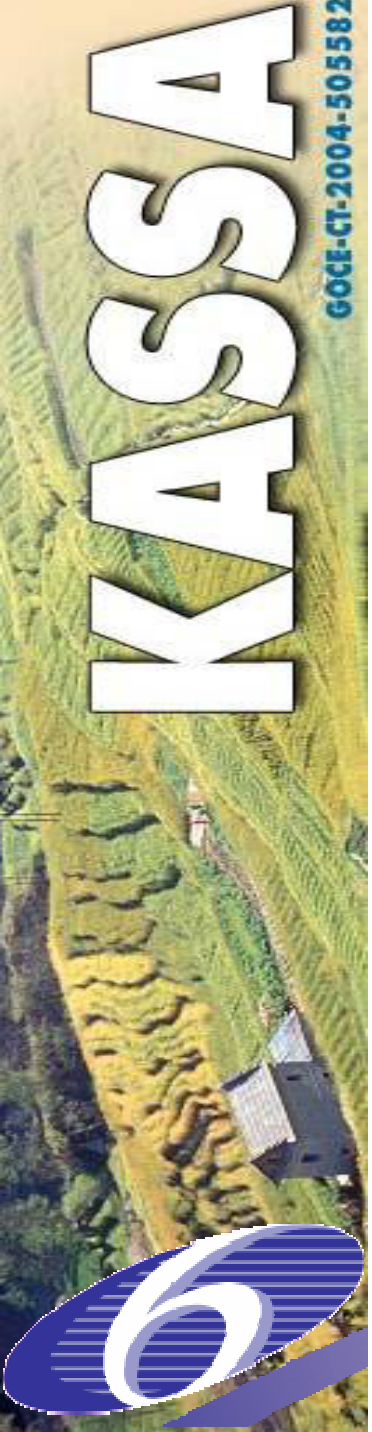

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Workpackage 4

SHARING KNOWLEDGE IN SUSTAINABLE AGRICULTURE

Session I

KASSA Main Results
The Mediterranean Platform

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The Mediterranean Platform Partnership

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The Mediterranean Agroecosystems

I. Climate and soil features

- Annual rainfall between 250 and 750 mm
  - Rainfall variable and erratic
  - High-intensity storms
  - Drought endemic and unpredictable

- Soils have medium to poor fertility
  - Calcareous horizons are frequent
    - Low water-holding capacity
    - Restricted root development and growth
  - Stony, alkaline or saline
  - Low organic matter content
  - More than 2000 years of cultivation

II. Mediterranean cropping systems

Rainfed farming systems

- Winter cereals (wheat and barley)
  - Traditional long-fallowing (16-18 mo)

II. Mediterranean cropping systems

Rainfed farming systems

- Tree crops: olives, almonds, nuts and vineyards

II. Mediterranean cropping systems

Irrigated farming systems

- Fruit trees: apple, peaches, pears, citrus, olives

II. Mediterranean cropping systems

Other crops

- Grain legumes (faba beans, lentils, chickpeas)
- Forage legumes (alfalfa, vetches)
- Canola, sunflower, potatoes, sugarbeet, cotton
- Livestock grazing on dryland permanent pastures

III. Ecological and environmental issues

Dryland areas

- Water scarcity
- Land degradation by soil erosion
- Overgrazing
- Stubble burning
- Lack of crop residue incorporation
- In southern countries, desertification is becoming a normal phenomenon

Irrigated areas

- Excessive and inefficient water and agrochemical use
- Environmental pollution still local
- Salinization

IV. Social and economic issues

- Marked differences between southern and Northern Mediterranean countries.
- Agriculture in the north is more advanced.
- The population in northern countries still engaged in agriculture is relatively low.
- New technologies have led to substantial increase in agricultural labour productivity.
- Social and economic issues (the need to reduce production costs and improve competitiveness) are similar to those in temperate climates.
- The European Mediterranean countries comply with evolving CAP regulations and policies.

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Conservation Agriculture (CA) in the Mediterranean Agroecosystems

- CA is not widespread around the Mediterranean
- CA is mainly used for winter cereals in monocropping or long fallows. Occasionally in rotations with legumes, sunflower and canola.

- Adoption in European Mediterranean countries greater than in North African countries.
- Reduction of intensive tillage in the region begun in the 1960`s (later in North African Countries) driven by the need of reducing inputs (fuel, machinery and labour).
- No-tillage and cover crops are used between rows of perennial crops (olives, nuts, grapes).

Scientific knowledge acquired regarding CA in Mediterranean agroecosystems

I. Researches undertaken

- CA research started by the design and setting of field experiments within research farms of public organizations (Universities, Agricultural Research Institutes).
- In some areas and countries, private companies, co-operatives and farmer associations played an important role in supporting CA research.
- Most studies have been short- or long-term specific-site tillage experiments (e.g., in Spain).
- Only a few experiments have been conducted as on-farm trials as a farmer's initiative.

II. Synthesis of main results.

(Conservation agriculture vs. traditional agriculture)

AGRONOMIC IMPACTS

Influence of CA on crop performance

- **Crop yield**: increases in CA
  - Positive response under dry conditions
  - Similar response under favourable conditions
- **Crop emergence and establishment**: positive or negative: f(site, crop); no effects on crop yield
- **Water use efficiency**:
  - Increases in rainfed farming areas
  - Similar under favourable conditions
- **Nutrient use efficiency**: Evidence for the improvement of this efficiency under CA practices

Influence of CA on crop management

- **Crop residue management**: Positive, the basis for CA
  - Better soil protection
  - Difficulties at sowing and early crop development in high or low residue production areas
- **Weed management**:
  - Change and inversion of flora with positive or negative impact
  - Weed control should be more precise, with careful use of herbicides
- **Pest and disease management**:
  - Negative incidences of specific pests and diseases in favourable wet areas

- **<u>Crop rotations</u>**:
  - Permit higher crop diversification
  - Positive for weed, pest and disease control
  - Positive for crop nutrient management

- **<u>Fallow management</u>**:
  - Increase or similar soil water storage at sowing
  - Crop residue maintenance and chemical fallow needed for optimum fallow performance in CA

- **<u>Intercropping and other crop associations</u>**:
  - Cropping system diversification
  - Double crop possibilities in some areas

ENVIRONMENTAL IMPACTS

Soil physical properties and processes

- Pore size distribution under conservation tillage more homogeneous
- Higher macroporosity under CA
- More biopores
- Higher aggregate size and stability under CA
- Increase in soil resistance to penetration
- Different long-term response in soil hydraulic conductivity
- CA improves soil water retention and water holding capacity
- CA reduces soil water evaporation

Soil chemical properties

- CA increases soil organic matter (SOM) and N content in top layers
- Lower nitrate levels in the soil profile
- Higher soil P and K stratification (higher values in top layers and lower in deeper horizons)

Soil biological properties

- CA improves enzymatic activity
- CA increases earthworm population

Herbicide and pesticide losses

- Lower mobility and persistence of herbicides in soils under conservation tillage

Greenhouse gases (GHG)

- CA increases soil organic carbon (SOC) content in the topsoil
- C stratification ratio increases
- Lower CO_2 emissions

Soil erosion

- Reduced soil losses due to wind and water erosion

SOCIO-ECONOMIC IMPACTS

- Input costs: higher or lower depending on situations and cost of herbicide and energy
- Labour costs: lower
- Energy (fuel) costs: lower
- Investment: higher initial investment (machinery)
- Time in cultural operations: lower
- Profitability:
  - In most cases higher or depending on the CA system and local conditions
  - Much better economy at a farm level

CONCLUDING REMARKS

- In Mediterranean agroecosystems, the transition to Conservation Agriculture is in progress.
- Conservation Agriculture not yet adopted by farmers. However, in some specific areas is possible to find farmers with more than 25 years of continuous CA practices.
- Scientific knowledge on crop and soil responses to Conservation Agriculture practices and their consequences for soil and water resources is still limited.
- **Sustainability of Conservation Agriculture in the Mediterranean region: a pending challenge**

THANK YOU FOR YOUR ATTENTION