Multi-Environment Experiment (MEE) UNITUS

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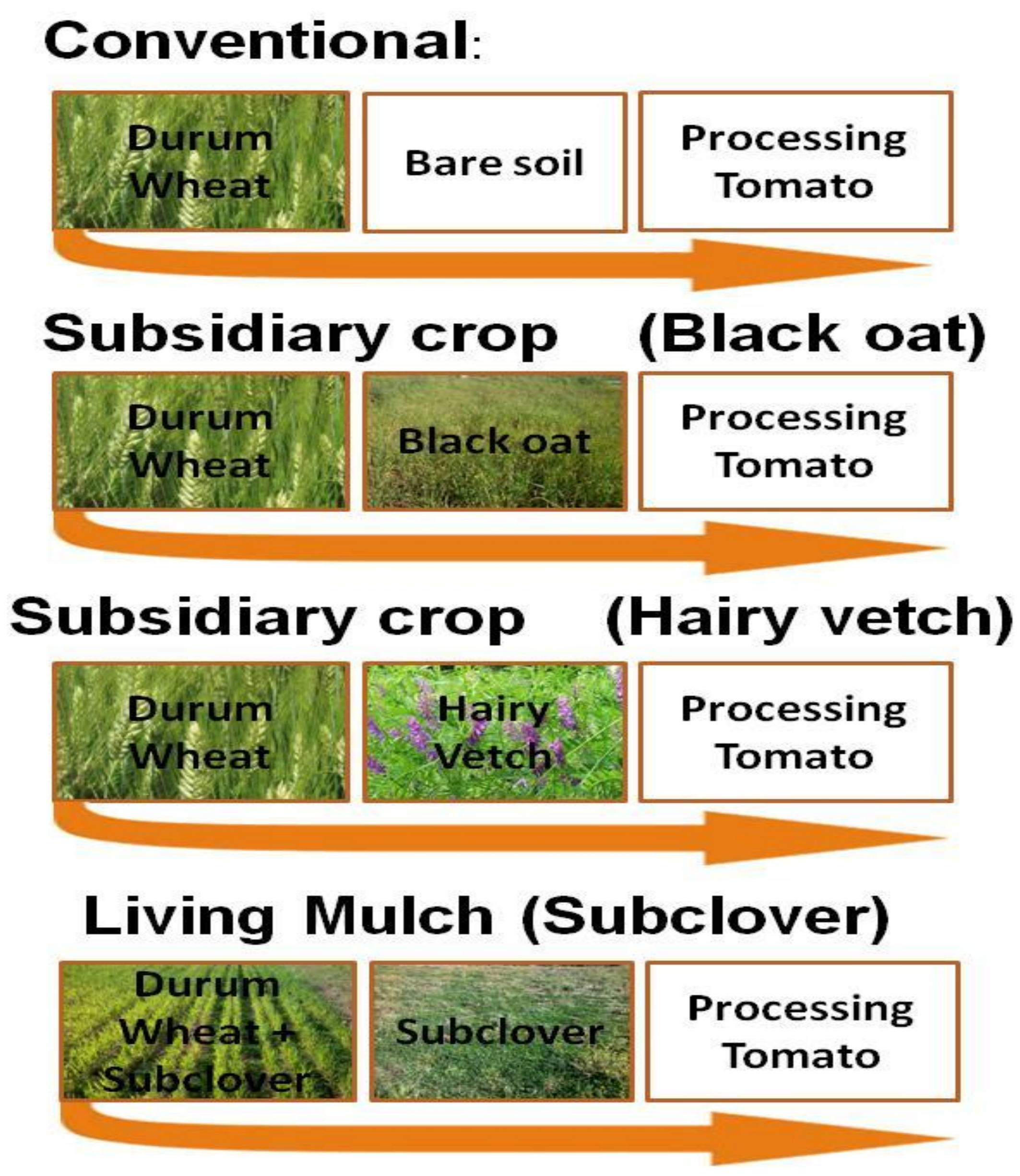
INTRODUCTION

Unsustainable farming practices, including soil tillage intensification and heavy use of agrochemicals, have an adverse impact on natural resources, biodiversity and the environment. Therefore, there is a need to improve actual agricultural practices. The introduction of cover crops and living mulches in crop rotations could be an efficient tool in order to stabilize crop yields, improve soil characteristics, and reduce external agricultural inputs such as herbicides and fertilizers. The overall objective of this experiment is to improve understanding and use of subsidiary crop in conservation agriculture systems under the Mediterranean environment of central Italy.

Figure 1. Cropping systems adopted in the Multi-Environemnt Experiment



I CYCLE OF MEE (2012/2013)

MEE Field experiment was set up in September 2012 at the experimental farm of Tuscia University (UNITUS). A 2-year durum wheat – tomato sequence was foreseen. In the first year of study the treatments consisted in: (i) four durum wheat – cover sequences (wheat + hairy vetch; wheat + avena strigosa; wheat/subclover + subclover; wheat + fallow); (ii) three nitrogen fertilization levels to the wheat (0%, 50%, and 100% of total nitrogen recommended dose).

The durum wheat (*Triticum durum* Desf., cv. Claudio) was sown in October at the seeding rate of 450 and 300 seeds m^{-2} in pure wheat and in intercropping with subclover, respectively. The subclover (*Trifolium subterraneum* L., cv. Campeda) was sown at the same time of wheat in strips 15 cm wide at the seeding rate of 15 kg ha^{-1} (Fig. 2). The phosphate fertilization was made with 80 kg ha^{-1} P2O5 as perphosphate applied at seedbed preparation, while the nitrogen fertilization was made with 0, 50, and 100 kg of N ha^{-1} applied twice at the beginning of the tillering stage in December and at the beginning of stem elongation in March (50% + 50% of total nitrogen, respectively).

Figure 3. The main effect of nitrogen fertilization level on the durum wheat grain yield at harvesting. Values belonging to the same characteristic and treatment without common letters are statistically different according to LSD (0.05).

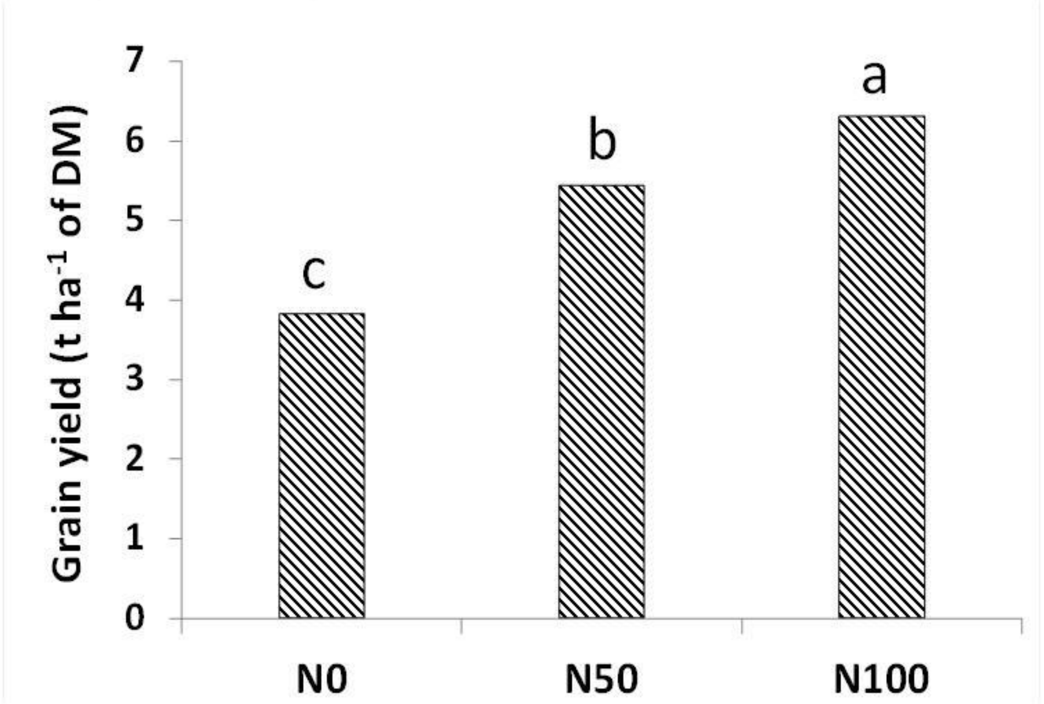


Figure 4. The main effect of nitrogen fertilization level on the wheat grain yield at durum wheat harvesting. Values belonging to the same characteristic and treatment without common letters are statistically different according to LSD (0.05).

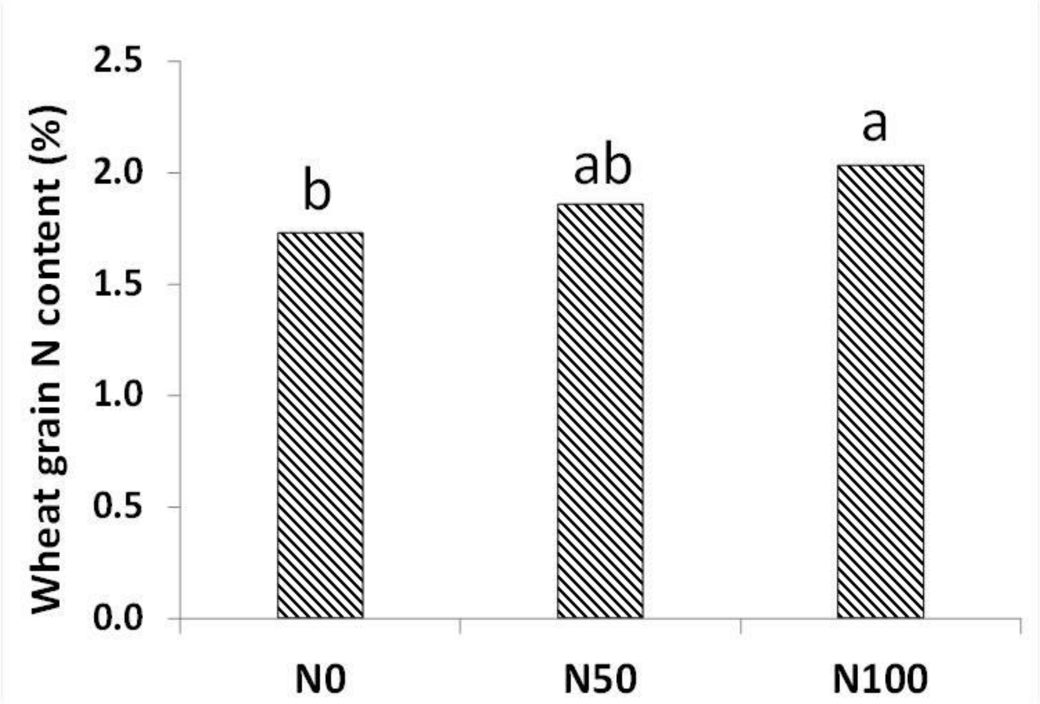


Figure 5. The main effect of nitrogen fertilization level on the subclover aboveground biomass at durum wheat harvesting. Values belonging to the same characteristic and treatment without common letters are statistically different according to LSD (0.05).

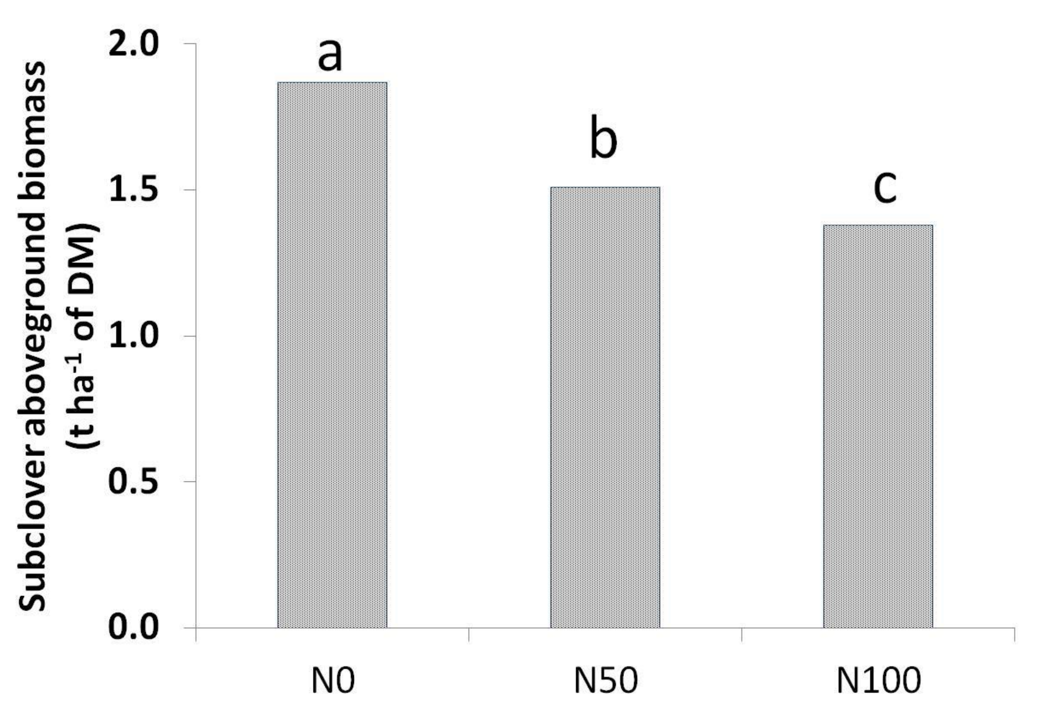


Figure 6. The main effect of nitrogen fertilization level on the subclover seeds at durum wheat harvesting. Values belonging to the same characteristic and treatment without common letters are statistically different according to LSD (0.05).

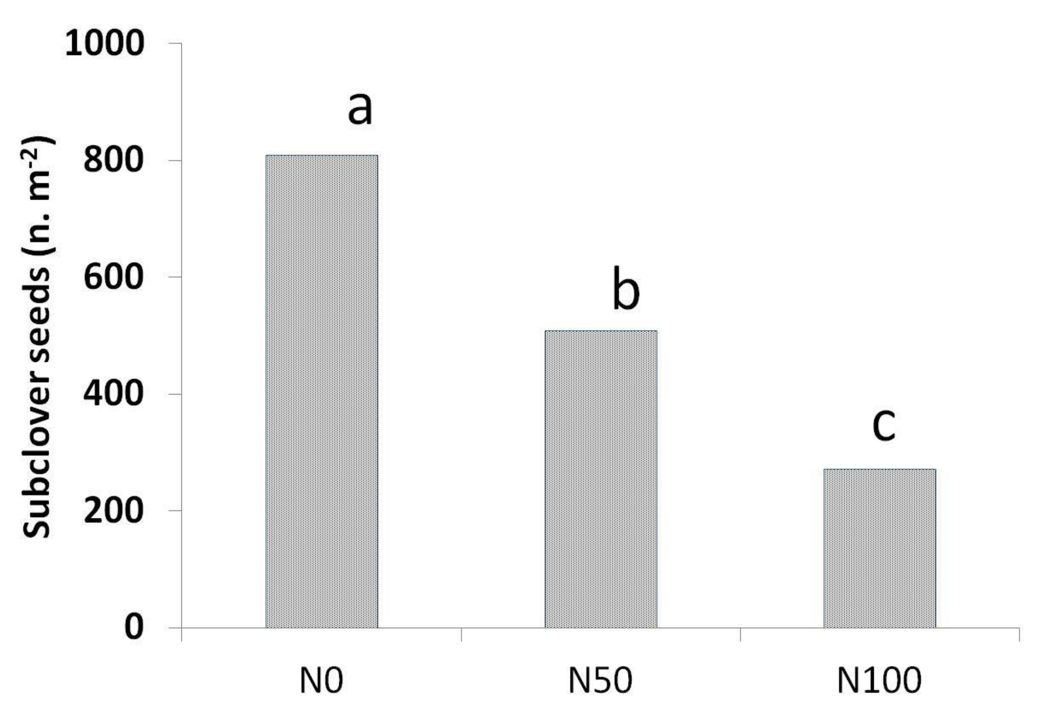
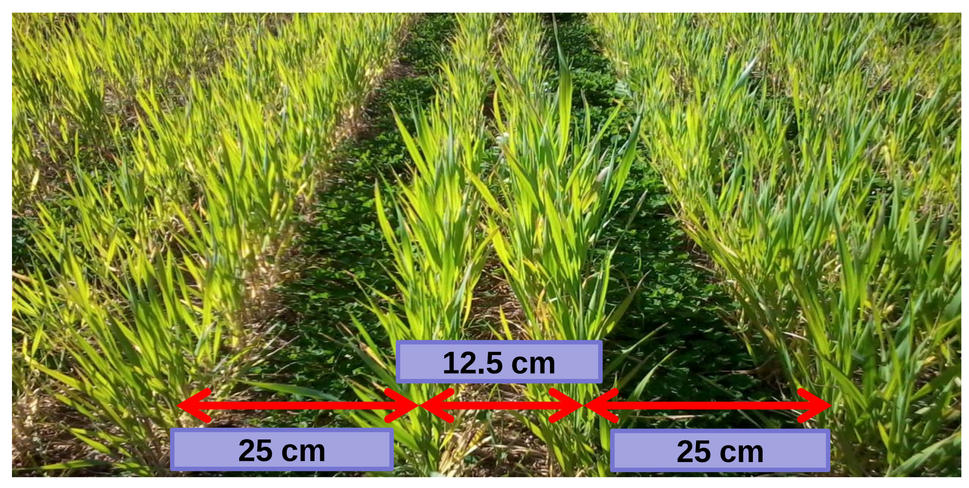


Figure 2. Spatial arrangement adopted in Durum wheat/subclover intercropping.



Wheat seedlings emerged regularly in all plots about two weeks after sowing (October 30, 2012), while the subclover seedlings emerged a week later (1st week of November 2012). No problems were observed at the emergence of both species. A few weed species emerged uniformly throughout the grain cropping season.

The wheat grain yield ranged from 6.3 to 3.8 t ha^{-1} of DM and it was similar between sole wheat and the intercropped wheat with subclover. As expected the nitrogen fertilization strongly affected the grain yield and it was higher in N100, intermediate in N50, and lower in N0 treatments (Fig. 3). Similar trend was observed in the nitrogen content of durum wheat grain yield (Fig. 4).

The subclover performances were strongly affected by nitrogen fertilization. Generally, the aboveground biomass of subclover was the highest in N0 (2.0 t ha^{-1} of DM), intermediate in N50 (1.9 t ha^{-1} of DM), and the lowest in N100 (1.7 t ha^{-1} of DM, Fig. 3). Similarly, the seed production of subclover followed the same trend (809, 508, and 271 n. of seeds m^{-2} in N0, N50, and N100, respectively, Fig. 6).

In September 2013, the plots where the pure wheat was harvested, were ploughed at a depth of 30 cm and disked twice to break soil clods for seed bed preparation. The cover crop species [Hairy vetch (*Vicia villosa* Roth. var. Villana) and Black oat (*Avena strigosa* L. Schreb. var. Pratex)] were sown on October 2013. The durum wheat – subclover intercropped plots were left undisturbed in order to allow the subclover seedlings to emerge and establish. At the moment (March 2013), all cover crops are at the end of the vegetative stage (Fig. 7).

II CYCLE OF MEE (2013/2014)

The experiment was set up in September 2013. The durum wheat and subclover were sown in November 7, 2013 adopting the same procedures reported for the first cycle of Multi Environment Experiment.

Wheat and subclover seedlings emerged contemporarily in November, 25 (about two weeks after wheat sowing). Both durum wheat and subclover species grow regularly without problems. At the moment, durum wheat is at the stem elongation stage, while subclover is in full vegetative stage.

Figure 8. Durum wheat pure crop and durum wheat - subclover intercropping of II cycle of MEE (March 2014)

Figure 7. Overview of I cycle of MEE (March 2014)