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The benefits of direct drilling on a farm in the Alentejo (Portugal)

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SUMMARY – The present work tries to show the positive modifications obtained on a farm located in the Alentejo region in the south of Portugal after 4 years of direct drilling. The soils in the study area are Luvisols, characterized by poor structure, bad internal drainage and cumulative negative effects of conventional soil tillage used before direct drilling. The effects after 4 years of direct drilling resulted in a reduction of erosion and soil compaction and improved physical, chemical and biological characteristics of the soil mainly by increasing the biological porosity and improving soil structure and stability. The improved soil conditions allowed a deeper root growth and higher infiltration rate and better soil bearing capacity. This has promoted the opportunities for applying nitrogen and herbicides. All together enhanced crop growth. Additionally a significant reduction was reported not only in the number of tractors and soil tillage equipment on the farm, but also in the maintenance and repair costs and in labour costs. Pulses (chickpea and peas) were introduced in rotation with winter cereals, and the farm adopted other practices within the direct drill system, such as the maintenance of straw on the soil surface and the utilization of special equipment for soil conservation (lighter tractors with double rear tires and straw dispersion equipment in the harvester). Despite the complete change regarding the soil management system (change of the whole farm to direct drilling), it was possible to maintain the perfect integration of animal (sheep) and crop production in the farming system, using crop residues only partially for animal feeding.

Keywords: Direct drilling, farmer's experience.

RESUME – *"Les bénéfices du semis direct dans une ferme de l'Alentejo (Portugal)". Le propos du présent travail est de montrer les modifications positives dans une ferme située dans la région de l'Alentejo, au Sud du Portugal, après 4 ans d'implantation du système de semis direct. Les sols de la zone d'étude sont des luvisols, caractérisés par une structure pauvre, un faible drainage interne et les effets négatifs cumulés du labour conventionnel du sol utilisés avant le semis direct. Les effets sur 4 ans du semis direct ont résulté en une réduction de l'érosion et du tassement du sol et de meilleures caractéristiques physiques, chimiques et biologiques du sol grâce à l'augmentation de la porosité biologique, et l'amélioration structurelle et la stabilité du sol. Ces meilleures conditions du sol ont permis une croissance des racines plus profonde, un taux d'infiltration plus élevé, et une meilleure capacité portante des sols. Ceci a amélioré l'opportunité d'application de l'azote et des herbicides. Tous ensemble ont augmenté la croissance des cultures. De plus on a enregistré une réduction significative non seulement du nombre de tracteurs et d'équipements de labour du sol dans la ferme, mais également des coûts de maintenance, de réparation et de main-d'oeuvre. Les légumineuses (pois chiches et pois) ont été introduites dans la rotation avec les céréales d'hiver, et la ferme a adopté d'autres pratiques en même temps que le semis direct, telles que le maintien de la paille en surface du sol et l'utilisation d'équipement spécial pour la conservation du sol (tracteurs plus légers à pneus arrières doubles et équipement de dispersion de la paille dans la moissonneuse). Malgré un changement complet en ce qui concerne le système de gestion du sol (passage de toute la ferme au semis direct) il était possible de maintenir une parfaite intégration de la production animale (ovine) et végétale dans le système d'agriculture, en utilisant seulement de façon partielle les résidus des récoltes pour l'alimentation animale.*

Mots-clés : *Semis direct, expérience de l'agriculteur.*

Introduction

Louseiro is a farm located in the Alentejo region in the south of Portugal. The soils of this farm are Luvisols, characterized by poor structure, bad internal drainage and cumulative negative effects of conventional soil tillage used before direct drilling (2002). The techniques used in conventional agriculture included practices such as crop residue burning, or deep soil inversion by tilling to control weeds and to prepare the seed bed.

These techniques (Fig. 1), considerably increased soil deformation by compaction, caused erosion (Fig. 2), and reduced the sustainability of agriculture by lowering soil organic matter and fertility, along

with further negative environmental effects (river contamination with sediments, fertilisers and pesticides, contributed to the increased level of emissions of CO_2 into the atmosphere and decreasing biodiversity).

Fig. 1. Conventional soil tillage.

Fig. 2. Soil erosion in the conventional system.

Under these conditions (Fig. 3), many times we did not have the opportunity to apply nitrogen and herbicides or we had to use special equipment (Fig. 4).

Fig. 3. Runoff and waterlogging.

Fig. 4. Special equipment in the conventional system.

All together it had a negative effect on crop growth and tillage operations required considerably higher inputs in machinery investment and maintenance, fossil fuels and labour inputs.

The benefits of direct drilling

Eliminating soil tillage and avoiding residue burning to maintain enough surface residue throughout the year, the soil is protected from rainfall erosion and water runoff, defending it from degradation processes (soil erosion and compaction) and less surface soil compaction occurs.

Now, we include as little as possible practices which may alter soil composition, structure and natural biodiversity. The effects after 4 years of direct drilling resulted in the reduction of erosion and soil compaction and improved physical, chemical and biological characteristics of the soil mainly by increasing the biological porosity (Fig. 5) and improving soil structure and stability.

The improved soil conditions allowed deeper root growth (Fig. 6) and higher infiltration rate.

Fig. 5. Increment of biological porosity.

Fig. 6. Deeper root growth.

There is better soil bearing capacity when improving the opportunity for applying nitrogen and post-emergence herbicides (Figs 7 and 8). All together enhanced crop growth.

Fig. 7. Applying post-emergence herbicides.

Fig. 8. Applying nitrogen.

Additionally a significant reduction was reported not only in the number of tractors and soil tillage equipment on the farm, but also in the maintenance and repair costs and in labour costs (Tables 1, 2 and 3).

Table 1. Number and costs of the tractors needed in the farm under conventional and direct drilling systems

Tractors in the conventional system	Tractors in the direct drilling system
FORD 7810 4RM (105 HP) - 45 000 €	
FORD 7740 4RM (98 HP) - 35 000 €	FORD 7740 4RM (98 HP) - 35 000 €
FORD 6610 4RM (86 HP) - 27 500 €	
FNH TL100 4RM (95 HP) - 35 000 €	DEUTZ Agrokid 4RM (45 HP) - 14 000 €
Total – 142 500 €	Total – 49 000 €

Table 2. Costs of soil tillage and seeding equipment under conventional and direct drilling systems

Conventional system		Direct drilling	
1 Rotary harrow	10 000 €		
2 Ploughs 3F 14”	8 740 €		
1 Plough 2F 18”	3 130 €	1 Seeder “SEMEATO” TDNG 300 SEED 17 Rows	
1 Disc harrow 20	5 680 €		
1 Disc harrow 24	6 500 €		
1 Disc harrow 26	8 360 €		
3 Tine cultivator 15	7 140 €	25 700 €	
1 Tine cultivator 13	1 760 €		
1 Sring tine cultivator 53	2 790 €		
1 Seeder 20 L	12 580 €		
Total	66 680 €		

Table 3. Reduction (%) of total costs under direct drilling (tractor and equipment repair and maintenance, fuel and labour)

	Conventional system (year 2000)	Direct drilling (year 2003)	Reduction (%)
Tractor repair and maintenance	10 450 €	1 507 €	85
Equipment repair and maintenance	8 158 €	1 840 €	77,5
Fuel	17 460 €	7 110 €	60
Labour	25 000 €	15 000 €	40
Total annual	61 068 €	18 347 €	70

Pulses (chickpea and peas) were introduced in rotation with winter cereals (Fig. 9), and the farm adopted other practices within the direct drill system, such as the maintenance of straw on the soil surface and the utilization of special equipment for soil conservation (lighter tractors with double rear tires and straw dispersion equipment in the harvester) (Figs 7, 8 and 10).

Fig. 9. Pulses in rotation.

Fig. 10. Combine with straw distributor.

Despite the complete change regarding the soil management system (change of the whole farm to direct drilling), it was possible to maintain the perfect integration of animal (sheep) and crop production in the farming system, using crop residues only partially for animal feeding (Figs 11 and 12).

Fig. 11. Direct drilled wheat.

Fig. 12. Integration of animal production.