European Commission

NWRM

Natural Water Retention Measures

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Individual NWRM

Early sowing

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I. NWRM Description

Early sowing refers to sowing up to six weeks before the normal sowing season. This allows for an earlier and quicker establishment of winter crops that can provide cover over winter and of a root network that leads to soil protection. The period in which the soil lies bare is shorter and, therefore, erosion and run-off are less significant and water infiltration is improved. Early sowing can also help to mitigate summer drought impacts on spring sown crops, in particular the extreme evapotranspiration rates of Mediterranean regions. However, early sown plants are frost sensitive; therefore farmers run the risk of losing the crops because of the low temperatures. In northern countries, temperature in spring (March) can be adequate but the risk of frost is still serious until May. The low temperatures in northern countries may also delay crop establishment in spring crops resulting in an increased risk of soil erosion, avoiding cultivation and retaining residues from preceding crops may be preferable. Therefore, early sowing may require specific tools (plastic tunnel covers, onsite green house, etc.) and cannot be applied by all farmers for all crops. Early sowing of spring crops may also require different cultivation techniques (reduced tillage, controlled traffic farming) as soils are likely to be saturated before usual sowing times increasing the risk of soil compaction.

Restrictions on early sowing of winter crops include the harvest date of the preceding crop (particularly root crops) which may be later in northern Europe. For both spring and winter crops, early sowing involves a number of trade-offs. For example, different pest and disease risks arise that might require changes in management.

II. Illustration

Illustration 1: early sown barley (India)

Source: http://sowasia.org/sowing-seeds-early/

III. Geographic Applicability

Land Use	Applicability	Evidence
Artificial Surfaces	No	Not applicable
Agricultural Areas	Yes	Arable land
Forests and Semi-Natural Areas	No	Not applicable
Wetlands	No	Not applicable

Region	Applicability	Evidence
Western Europe	Yes	No data are available on the current implementation of early sowing. In northern Europe early sowing of spring crops may be limited by soil saturation and risk of soil compaction. Some early sown crops are also at risk from frost.
Mediterranean	Yes	No data are available on the current implementation of early sowing.
Baltic Sea	Yes	No data are available on the current implementation of early sowing. In northern Europe early sowing of spring crops may be limited by soil saturation and risk of soil compaction. Early sown crops are also at risk from frost.
Eastern Europe and Danube	Yes	No data are available on the current implementation of early sowing.

IV. Scale

	0-0.1km^2	0.1-1.0km^2	1-10km^2	10-100km^2	100-1000km^2	>1000km^2
Upstream Drainage Area/Catchment Area	✓	✓				
Evidence	This measure acts at field level and operations at larger scales such as whole farms may be constrained by crop rotations. Implementation over larger areas may require significant coordination and incentive programmes.					

V. Biophysical Impacts

Biophysical Impacts		Rating	Evidence
Slowing & Storing Runoff	Store Runoff	None	
	Slow Runoff	High	Early sowing can increase the level of vegetation cover which will slow run-off. Defra (2005) recommends sowing of winter cereals should be early enough to ensure 25% cover by early winter, i.e. no later than mid-late September in lowland England. For spring cereals Defra (2005) does not recommend early sowing particularly on field with high erosion risk. O'Connell et al (2007) report that winter cover crops in maize production can reduce run-off by up to 80%. The impacts of early sowing are likely to be lower as full crop establishment is not the aim and differences in crop and soil types are likely to be important.
	Store River Water	None	
	Slow River Water	None	
Reducing Runoff	Increase Evapotranspiration	Medium	No evidence specific to early sowing was found, however, the impacts are likely to similar, though of lower magnitude to those for green cover (see NWRM measure A8). Evapotranspiration is potentially higher than for bare soils, since plants reject water in the atmosphere. However, evapotranspiration balance highly depends on climate conditions and cover type; the impact of green cover on evapotranspiration is not systematic. Justes et al (2012) showed that catch crops can reduce winter drainage by 20 to 50mm in France; this reduction results from the combination of two factors; increased evapotranspiration and increased infiltration.
	Increase Infiltration and/or groundwater recharge	Low	No evidence specific to early sowing was found, however, the impacts are likely to similar, though of lower magnitude to those for green cover (see NWRM measure A8). Green cover implies that the soil is not bare in winter, but covered by plants. Root systems enable infiltration, thus leads to reduce surface runoff. Justes et al (2012) showed that catch crops can reduce winter drainage by 20 to 50mm in France; this reduction results from the combination of two factors; increased evapotranspiration and increased infiltration. In a study carried out in Georgia (Reeves , 2005), green

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			cover associated with no tillage results in between 12 and 46% of water savings thanks to increased water infiltration.
	Increase soil water retention	High	No evidence specific to early sowing was found, however, the impacts are likely to similar, though of lower magnitude to those for green cover (see NWRM measure A8). In some cases, green cover can also reduce evapotranspiration thus increase soil water retention capacity. This was demonstrated in Estonia, in afforested land, where green cover helped increasing soil water retention (BIO Intelligence Service with support from Hydrologic, 2014).
Reducing Pollution	Reduce pollutant sources	None	
	Intercept pollution pathways	None	
Soil Conservation	Reduce erosion and/or sediment delivery	High	No evidence specific to early sowing was found, however, the impacts are likely to similar, though of lower magnitude to those for green cover (see NWRM measure A8). By covering the soil with plants, green cover reduces runoff (see above) thus erosion; it also reduces wind erosion compared to a bare soil. A study conducted by the Joint Research Centre of the European Commission (2009) showed that in Belgium, covered soil can reduce erosion by 50% compared to bare soil. In England and Wales (R.D.Gooday, 2014), sediments loss reduced by 2.2 to 4.2% on green covered soils compared to bare soils.
	Improve soils	Medium	Arvidsson et al (2000) in a study of early sown spring cereals found no significant differences in the impacts of sowing date and bulk density (tillage method was significant).
Creating Habitat	Create aquatic habitat	None	
	Create riparian habitat	None	
	Create terrestrial habitat	None	
Climate Alteration	Enhance precipitation	None	
	Reduce peak temperature	None	

	Absorb and/or retain CO_2	Medium	Justes et al (2012) report that green cover could increase soil carbon take up by 300kgC/ha (±150kgC/ha).

VI. Ecosystem Services Benefits

Ecosystem Services		Rating	Evidence
Provisioning	Food provision	High	Arvidsson et al (2000) report that early sown spring barley had a 1% higher yield than when sown at the conventional time. The improvement in yield was higher the earlier the time of sowing. Dejoux et al (2003) report in trials of very early sowing up to one month before normal sowing of oilseed rape in France. Yields for normal sowing were slightly lower and had a wider range than those for early sowing: • Normal sowing: 1.1 to 4.1 t/ha • Very early sowing: 2.3 to 4.4 t/ha
	Water Storage	None	
	Fish stocks and recruiting	None	
	Natural biomass production	None	
Regulatory and Maintenance	Biodiversity preservation	None	
	Climate change adaptation and mitigation	Medium	By enabling increasing carbon sequestration in the soil (see above), green cover plays a role on both climate change adaptation and mitigation.
	Groundwater / aquifer recharge	High	By enhancing infiltration (see above), green cover contributes to groundwater recharge. In a study carried out in Georgia (Reeves D. W., 2005), green cover associated with no tillage results in between 12 and 46% of water savings thanks to increased water infiltration.
	Flood risk reduction	High	By slowing down runoff up to 80% (O'Connell E., 2007) and reducing runoff up to 50mm (Justes.E, 2012), green cover contributes to reduce flood risk caused by drainage water from agricultural areas.
	Erosion / sediment control	High	Early establishment of crop cover can reduce runoff (see above) thus erosion; it can also reduce wind erosion compared to a bare soil. A study conducted by the Joint Research Centre of the European Commission (2009) showed that in Belgium, covered soil can reduce erosion by 50% compared to bare soil.

			In England and Wales sediments loss reduced by 2.2 to 4.2% on green covered soils compared to bare soils (Gooday et al, 2014).
	Filtration of pollutants	Medium	Early sowing of winter crops may reduce nitrate leaching (Defra, 2005) by taking up the residual nutrients in the soil. The literature in this respect concentrates on cover crops, where the evidence may not be directly transferable to early sowing.
Cultural	Recreational opportunities	None	
	Aesthetic / cultural value	None	
Abiotic	Navigation	None	
	Geological resources	None	
	Energy production	None	

VII. Policy Objectives

Policy Objective		Rating	Evidence
Water Framework Directive			
Achieve Good Surface Water Status	Improving status of biological quality elements	None	
	Improving status of physico-chemical quality elements	None	
	Improving status of hydromorphological quality elements	Medium	Early sowing can contribute to improving hydromorphological status by reducing sediment loss through reducing the area of bare soil.
	Improving chemical status and priority substances	None	
Achieve Good GW Status	Improved quantitative status	Low	Early sowing may improve groundwater quantitative status by increasing infiltration due to both reduced surface flow and the establishment of root channels. Risks of soil compaction would need to be mitigated.
	Improved chemical status	None	

Prevent Deterioration	Prevent surface water status deterioration	Medium	Early sowing of winter crops can reduce nitrate leaching through uptake of residual nutrients.
	Prevent groundwater status deterioration	Low	Early sowing can contribute to groundwater status through reduction in nitrate leaching.
Floods Directive			
Take adequate and co-ordinated measures to reduce flood risks		High	Early sowing can contribute reduced flood risk through reduction in run-off rates.
Habitats and Birds Directives			
Protection of Important Habitats		None	
2020 Biodiversity Strategy			
Better protection for ecosystems and more use of Green Infrastructure		High	Early sowing and consequent increase in soil cover can contribute to this objective through reducing soil erosion and sediment delivery.
More sustainable agriculture and forestry		Medium	Early sowing where applied appropriately can offer a number of benefits that contribute to sustainable agriculture. These include reduced nitrate leaching, reduced soil erosion.
Better management of fish stocks		None	
Prevention of biodiversity loss		Medium	Establishment of crops following early sowing provide a habitat for fauna.

VIII. Design Guidance

Design Parameters	Evidence
Dimensions	
Space required	
Location	
Site and slope stability	
Soils and groundwater	
Pre-treatment requirements	Early sowing of spring crops requires an appropriate seedbed. This might require the use of reduced tillage methods such as direct drilling. Care is also required to avoid risk of soil compaction.
Synergies with Other Measures	In northern countries where soils may saturated the use of early sowing in combination with methods including reduced or no-tillage (e.g. direct drilling) and controlled traffic farming may be desirable to avoid soil compaction.
Design recommendations	According to Chambre d'Agriculture de la Lorraine, several recommendations are to be followed to achieve profitable production objectives (2T dry matter/ha): => early sowing to benefit from water and sun (in France) => choice species adapted to needs; legumes are interested alone or in association with other species => adapting sowing density to yield objectives => quality of seed bed : species are more or less sensitive to good quality => soil type and nitrogen status of the field: filtrating and superficial soils enable less plant development. Nitrogen leftovers lead to more biomass production.

IX. Cost

Cost Category	Cost Range	Evidence
Land Acquisition	0	Measure is a change in land management practices and does not involve land acquisition
Investigations & Studies	0	Measure does not require pre-implementation studies
Capital Costs	0	The measure in itself does not incur capital costs. But there may be capital costs associated with changes in tillage and other practices that are used to implement early sowing.

Maintenance Costs	0	The measure in itself does not incur maintenance costs. But there may be costs associated with changes in tillage and other practices that are used to implement early sowing.
Additional Costs	0	Early sowing can be associated with different pest and disease risks (Defra, 2005). These may require different management to conventional practices, but might not incur additional costs. Early sowing may also help to spread on-farm workload.

X. Governance and Implementation

Requirement	Evidence
Farm advice and demonstration	Uptake of measures such as early sowing involve uncertainty for farmers including potential trade-offs of yield and input costs. The full benefits may not be realised for several years post implementation. Demonstration of the benefits and advice to tailor the techniques to the circumstances of individual farms are important.

XI. Incentives supporting the financing of the NWRM

Type	Evidence
Rural Development payments for associated measures	Early sowing is not directly supported as a measure in the 2007-13 Rural Development Programme. However, associated measures such as soil management, i.e. changes to crop rotation and ploughing regime, are available. Payments for these across the EU average 97 €/ha with a range of 94 to 100 €/ha

XII. References

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