The percentage rest crop explained

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Introduction

In the following we explain how we have arrived at the indicator designated as "percentage rest crop". It is a score that is calculated on the basis of agricultural data pertaining to one particular agricultural field. The purpose of this, is to have an indicator for evaluating the choices a farmer is making as far as the type of crops is concerned which he grows on his field.

Background

The planting of so-called "rest crops" is one of the cropping practices proposed for so-called eco-schemes. The proposal should be seen against the background of the changing involvement of the Dutch government and of the European Union (EU) in agriculture. For many years, the Common Agricultural Policy (CAP) - as implemented by the EU in cooperation with the Dutch government – used to reward individual farmers with subsidies purely for the amount of agricultural product they produced. With the growing realisation in Dutch society in the past 10-15 years or so, that farmers are also guardians of nature, the landscape and the environment at large, it is generally felt that new ways are needed for rewarding individual farmers. The idea is therefore that the CAP should be modified and that rewards should be integrated into it for the services they provide to society – i.e. ecosystem services such as soil and water conservation and biodiversity-friendly farming.

Many Dutch farmers are already familiar with the concept "rest crop". The idea behind this concept is that such a crop gives the soil some rest:

- contrary to root crops, the crops which are counted as "rest crop", do neither require deep soil tilling nor disturbance of the soil during harvesting
- rest crops are assumed to have lower demand for nutrients than crops which are not counted as "rest crop"
- rest crops are assumed to contribute to the organic matter of the soil, because it's assumed that the largest part of the produced biomass is left in place to break down.

There is a special crop group called leguminous crops which in principle have a low requirement for nitrogen, because those crops are able to establish a symbiotic relationship with Rhizobium bacteria provided the right conditions are present or created. Those bacteria are able to fix nitrogen from air, which they exchange with the plants in exchange for carbohydrates. The crops belonging to the leguminous crops are often considered to be in a class of their own. This is our approach too, meaning that besides a "percentage rest crop" we also distinguish a "percentage leguminous crop".

Our aim was to develop an indicator which shows which part of his / her total cultivated area a farmer is cultivating with the mentioned rest crops. It should be possible to derive the indicator from undisputed data. The data we had in mind in particular are those which every farmer declares himself / herself every year to the government service RVO – part of the Dutch Ministry of Economic Affairs.

This declaration is called "Combined Declaration" and includes main crop type during the calendar year for every parcel in use by the farmer. Data from the "Combined Declaration" are made available in a strictly anonymised form to researchers, i.e. per land parcel.

Starting points

It was considered that the following would be a suitable crop categorisation:

- rest crops
- leguminous crops
- root crops
- permanent crops

To make it complete, we felt that we had to also distinguish "black fallow" as well as "other crops". Thus we arrived at the following table:

Letter	Description
R	rest crop
W	root crop
P	permanent crop
Z	black fallow
E	leguminous crop
O	other crops

In order to make the above distinction applicable to the data from the RVO declaration, we classified every crop in the RVO crop list according to the above table. We tried to be consistent with the following list, which has apparently been taken from a policy document pertaining to the CAP. On many occasions reference was made to this list (in Dutch):

code	gewas	code	gewas	code	Gewas
235	Wintergerst	666	Lijnzaad	1036	Wortelpeterselie
236	Zomergerst	258	Luzerne	1037	Peterselie
1921	Graszaad	664	Raapzaad	247	Blauwmaanzaad
238	Haver	3807	Rietzwenkgras	799	Rode klaver
944	Hennepvezel	237	Rogge	3524	Witte klaver
3512	Italiaans raaigras	3519	Sorghum	516	Miscanthus
246	Karwijzaad	233	Wintert tarwe	382	Spelt
3506	Engels raaigras	234	Zomer tarwe	1022	Quinoa
1922	Winter koolzaad	381	Teff	2652	Overige granen
235	Wintergerst	314	Triticale	331	Grasland, tijdelijk met kruiden
236	Zomergerst	3523	Veldbeemgras	332	Grasland, tijdelijk gras/klaver
1921	Graszaad	3523	Veldbeemdgras	266	Grasland, tijdelijk
1923	Zomer koolzaad	3736	Vezelvlas		

The list contains 37 different crops (and contains a few typos). The RVO crop list however contains approximately 450 crops. It means that the list shown above is not exhaustive. Inspired by the above list, we tried to identify which other crops in the RVO crop list should be regarded as rest crops.

Another list was obtained – apparently from the Dutch Ministry for Agriculture, Nature and Food Quality. This list is said to have been composed in the

framework of the National Protein Strategy (2020). It contains crops that should be regarded as leguminous crops (in Dutch):

Code	gewas	code	Gewas	code	Gewas
311	Bonen, veld-	853	Bonen, tuin- (droog te oogsten) (geen consumptie)	426	Overige groenbemesters, vlinderbloemige-
801	Esparcette	854	Bonen, tuin- (groen te oogsten)	2747	Peulen, productie
799	Klaver, rode	308	Erwten (droog te oogsten)	2748	Peulen, zaden en opkweekmateriaal
663	Lupinen, niet bittere-	244	Erwten, groene/gele, groen te oogsten	2751	Pronkbonen, productie
258	Luzerne	241	Kapucijners (en grauwe erwten)	2752	Pronkbonen, zaden en opkweekmateriaal
800	Rolklaver	3500	Klaver, Alexandrijnse	2779	Stamsperziebonen (=stamslabonen), productie
665	Sojabonen	3511	Klaver, incarnaat	2780	Stamsperziebonen (=stamslabonen), zaden en opkweekmateriaal
803	Wikke, voeder-	3515	Klaver, Perzische	2781	Stoksnijbonen en stokslabonen, productie
242	Bonen, bruine-	3524	Klaver, witte	2782	Stoksnijbonen en stokslabonen, zaden en opkweekmateriaal
		804	Klaverzaad	802	Wikke, bonte

Inspired by this list, we tried to also identify which other crops in the RVO crop list should be regarded as leguminous crops.

After this, we classified the crops / cultivations in the RVO crop list which remained:

- as root crop (W), when the crop has bulbs, tubers, corms, rhizomes – esp. when it is that part of the plant that needs to be harvested
- as permanent crop (P), when the crop is perennial or is left to grow for a period longer than one year; this includes permanent grassland, natural grassland and other natural vegetation
- as black fallow (Z) when the soil is left uncovered during a considerable part of the year or is rather covered by an impermeable layer
- as other crop (O), anytime a crop / cultivation did not fit any of the above descriptions.

Algorithm

In general, the indicator percentage rest crop is calculated per farm for one year. The total area with rest crops is calculated and divided by the total area as calculated for all the fields of the farm. The obtained fraction is multiplied with 100%. The assumption is that over the years crops rotate over the various fields. In some years a farmer may actually plant extra rest crops and in other years less. The percentage rest crops can therefore vary considerably over the years.

To obtain a more stable estimate for the percentage rest crop, it is sometimes calculated over the past 6 years. The best would be to calculate the indicator first per field over those past 6 years. However, fields are sometimes split up or rather merged with other fields.
Suppose we are analysing such a field, then it is possible to weigh the percentages over time – i.e. with the field sizes - and to arrive at a percentage

rest crop for that field. However – when we want to arrive at a value representative for the whole farm – then combining the value obtained for that field with values for other fields is not straightforward.
Hence the percentage rest crop over 6 years is determined by just averaging the percentages rest crop as obtained for the 6 years for the whole farm.

The percentages root crop and leguminous crop are determined in the same way.

Application

The percentages rest crop, root crop and leguminous crop are indicators for crop rotation. When calculated for one year, they can only be calculated for the whole farm. When calculated over the past 6 years, they can also be calculated per parcel. They are all percentages, meaning that they vary between 0 and 100%, with higher values indicating more favourable conditions.