

Eric Anderson - Biography

Eric Anderson is the Potato Specialist and Senior Agronomist for Scottish Agronomy Ltd., which provides strategic advice to a large, UK-wide and international client base. Eric has twenty-two years of practical experience, providing consultancy to a diverse range of farm businesses and commercial enterprises including co-operatives, farmer groups and multi-national agrochemical businesses, potato merchants, processors, fertiliser manufacturers and seed breeders in the UK, Japan, U.S.A., Hungary, Germany, Denmark and Poland.



His earlier interests in the potato covered the growth and development of the crop, providing an in-depth understanding of potato physiology and a sound foundation for managing the agronomy of the crop. Latterly he has investigated methods of defoliating potato haulm to maintain skin quality whilst achieving control of tuber size distribution.

Eric is in demand as a specialist speaker at British Potato Council meetings throughout the country and other public speaking engagements. He is a regular contributor to British Potato Council workshops and management courses including a major series of soil management workshops in 2006 and 2007 throughout the UK on soil compaction and cultivations together with the effects of soil fertility and fertiliser applications on potatoes. He has extensive research and consultancy experience in relation to potato haulm destruction, conducting a major series of BPC knowledge transfer workshops in 2006 and 2007 in relation to haulm destruction.

He is a Director of Scottish Agronomy Ltd., which is devoted to the provision of impartial and objective advice to arable farmers. Its client base includes 205 of the lead cereal growers and 83 of the lead potato growers in Scotland. 52,000 Ha of cereals and 6,000 Ha of potatoes are grown by members - representing 48% of cereals on holdings over 150 Ha and 33% of potatoes grown on holdings growing more than 15 Ha in Scotland.

Flail & Spray The System

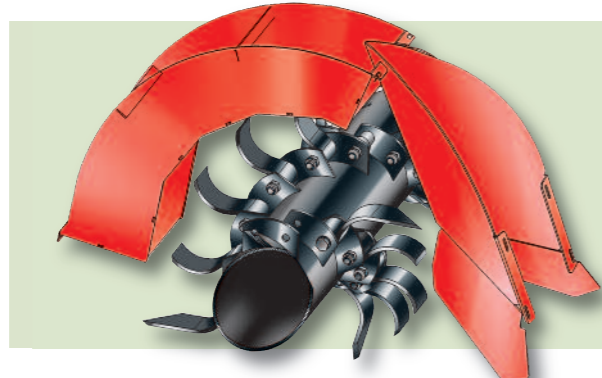
How the System Works

Until recently sulphuric acid was used as the major desiccant for the UK potato crop, but due to concerns from supermarkets its popularity is declining. Flailing and spraying is now the alternative to acid and with the option of multi row toppers now available on the market the speed of the operation is much enhanced from early systems of flail and spray. The system is easily described – basically the topper removes most of the leaf and top stems to leave an upright stem of about 15 to 20cm onto which chemical is applied by a sprayer either mounted on the topper or as a separate operation.

The flail and spray as one operation has an initial cost of the equipment and the requirement to achieve the best possible flailing to leave the stems clear of debris for chemical application. In some instances a subsequent desiccant application could be required. The flail operation followed by the sprayer operation is a less expensive method as the farm sprayer can be used, but this cost has to be offset against a one-pass system and the application of the chemical at perhaps the ideal time.

The application to some crops of a desiccant before flailing followed by another desiccant application after flailing is a system some growers adopt for their own reasons as is the system flailing and spraying separately.

It is impossible to state the correct system, however the systems are flexible. What can be stated is that cost of the operation must be investigated as well as the subsequent harvesting operation, which might well be enhanced by a higher flail and spray cost giving a quicker and easier harvester operation in terms of output and damage to the crop.



FLAIL AND SPRAY

Carfentrazone (Spotlight Plus) positioning

Use Spotlight Plus as a stem desiccant, immediately after flailing as part of the same operation or as a separate operation up to a week after flailing or using an alternative chemical desiccation spray. On ware crops the maximum individual dose is 1.0 litres/ha (60g a.i./ha equivalent to 0.25 litres of Spotlight 24EC). The maximum total dose is 1.6 litres/ha. On seed crops, Spotlight Plus now matches the flexibility of the ware crop recommendations. As Spotlight Plus is an excellent stem desiccant there is very little re-growth following application in a flailed crop but it is less active on mature leaves. Therefore the best way to use Spotlight Plus is in sequence with a flail or an alternative chemical desiccant.

Carfentrazone (Spotlight Plus)

Strengths

- Low rate 60g a.i./l (ME)
- 'Built in' wetting system -no need for additional oil
- Flail combination & T3 possible
- Excellent at preventing regrowth
- Excellent stem desiccant
- Environmental profile, easy to use low dose product - less active ingredient loading for the crop and the environment and less packaging waste.
- No water buffer zone restriction
- Can apply in wet and dry soil conditions
- Rainfast in under 1 hour
- 7 day harvest interval
- Can be tank mixed with Ranman TP, Shirlan, Electis
- T2 @ 1.0 l/ha or T3 @ 0.6 l/ha
- Preferred T2 desiccant on salad or vigorous haulm types

Weaknesses

- Do not use as a T1 product as product is weak on mature leaf unless used after flailing or if the crop >60% senesced
- Some indeterminate varieties with vigorous canopies may need sequence of 3 sprays
- Slow activity, needs warmth and sunshine

Glufosinate-ammonium (Harvest) positioning

On crops where senescence has started, use Harvest at 3 litres/ha as the first application and follow up 7 to 10 days later with Reglone, Spotlight Plus or even acid if required. On crops where senescence has started but varieties have dense, long haulm, use Reglone at 2.0 l/ha and follow up with Harvest 7 to 10 days later. For salad crops, seed crops, or those crops where seed may be saved, flail and spray is the only option

Glufosinate-ammonium (Harvest)

Strengths

- Rapid action in warm bright conditions
- Flail combination possible
- Good environmental profile
- 7 day harvest interval
- Can be tank mixed with Infinito, Shirlan and Electis

Weaknesses

- Slow when cool/dull
- Restrictions if wet soil
- Apply after the onset of senescence when used overall, approved on ware crop ONLY
- Can be used on all varieties except Kerrs Pink
- Not for use on seed unless flail fb Harvest
- Slower stem desiccation
- Requires 2-4 hours drying after application.
- One rate 3.0 l/ha
- Follow up with different approved desiccant if re-growth occurs after using Flail + Harvest.

Grimme System

Two Row

KS75-2

Two row topper with shear plate and wheeling deflectors. Front or rear mounted.

KSA75-2

Two row model fitted with cross conveyor.

Four Row

KS3600

Four row topper with shear plate and wheeling deflectors, road lights and end tow kit. Front or rear mounted.

Six Row Fixed

KS5400

Six row topper with shear plates and wheeling deflectors, road lights and end tow kit. Rear mounted and front mounted with hydraulically operated outer depth wheels. Separate rear mounted sprayer system offers flail and spray.

Six Row Folding

KS6000

Six row topper with matched blade/shear plate configuration. Front unit and rear units on folding frame. Each unit independently fixed to follow ground contours. Mounted sprayer as a fitted offering flail and spray in one pass.

Ridge Runners

UF6000

Available to fit directly onto all topper models or fitted on a separate toolbar (UF6000) when the topper is front mounted or to use as a stand alone operation.

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Flail & Spray The Agronomy

Pressures for change

Up until four years ago, sulphuric acid accounted for 36% by weight of all active ingredients used in agriculture, and 79% by weight of pesticide active ingredients used in the potato crop. With multiple retailers urging growers to shun acid desiccation there are plenty of effective alternatives, including increasingly popular flailing, to do the job more cheaply.

Considerations when planning haulm destruction

Effects on tuber quality: Vascular browning, greening and surface blemish diseases.

Cost and timeliness

Efficacy - aim for no regrowth and detachment of stolons at harvest

- avoid spread of Erwinia & Blight

Environmental concerns

Consumer concerns - protocols

Weather and soil conditions

Acid is cleared until Dec 2013

The destruction of potato haulm is necessary to reduce Late Blight and virus spread, to reduce interference at harvest, to improve skin-set and to control tuber size. Haulm is increasingly removed by a combination of desiccants and flailing as part of an ongoing policy to meet the demands of customers and consumers to reduce pesticide use. Haulm destruction must be thorough as partially destroyed haulm and haulm regrowth can cause similar problems to untreated haulm. Thorough destruction also hastens tuber skin set thus can aid earlier harvest and the control of surface blemish diseases. Haulm regrowth is greatest in crops in which the haulm is destroyed early at a time when the foliage is growing strongly. This is encouraged by warm weather, and where drought is followed by rain. The young leaves of plants exhibiting regrowth are more susceptible to diseases such as Blight than mature haulm. Where regrowth occurs or haulm is only partially destroyed, re-treat the haulm with a suitable Blight fungicide as soon as possible to prevent disease reaching the tubers.

Achieving good skin set is not just a matter of haulm destruction but also requires an element of agronomic consideration. Variety, soil type, planting date, nitrogen application, prevailing weather, temperature and soil moisture levels will all have an influence. It is essential to monitor crops adequately and to plan defoliation date

Continues on centre spread

together with scheduling irrigation to the chosen defoliation date. Choose the method of haulm destruction according to individual crop and growing conditions. There is no single best approach. Actively growing crops (e.g. seed and some salad crops) are prone to regrowth. Indeterminate varieties with large canopies are more difficult to defoliate than senescing crops. The speed of haulm kill will be determined by maturity of the crop, effective desiccant spray coverage of the haulm together with the conditions at time of application and the period immediately after.

Interval to lifting

Except where there are particular problems with haulm regrowth that require early lifting, tubers should be allowed to mature and set skin for some time before lifting. Otherwise they will be more susceptible to damage and subsequent infection. Crops destroyed early require longer for tubers to mature than crops destroyed later; they are also more susceptible to Dry rot in warm weather. Blight sporangia can remain active and infective in the soil for up to eight weeks post-desiccation. Although sporangia viability begins to decline as soon as the crop is desiccated, growers must be looking to protect tubers in the ground for as long as possible with a suitable fungicide with tuber Blight activity. Maintain a full fungicide programme until desiccation is complete. A minimum interval of 3 weeks between complete haulm destruction and harvesting is recommended. Crops destroyed later generally require less time for tubers to mature, but as lifting is delayed these crops are more prone to Gangrene, Skin spot, Blackdot and Blackscurf. These crops are best lifted about 14 days after the haulm is completely destroyed, and should not be left for more than 3 weeks, if possible. Blighted crops should not be lifted earlier than 14 days after haulm destruction to prevent contamination of the tubers.

Why Flail?

Haulm needs to be removed at some point in the harvest process, otherwise it causes choking at the mouth of the harvester together with the nuisance of haulm wrapping round rollers and web drives. Furthermore, haulm rollers set in a position to remove copious amounts of haulm can cause tubers to be caught, crushed and damaged.

Flailing immediately prior to harvesting can be carried out to allow easier lifting where desiccation by chemicals has been inadequate to reduce interference by the haulm. The use of a front mounted flail on the harvester tractor, however, requires additional horse power but more importantly high engine revolutions to create suction underneath the hood of the flail in order to obtain the desired result. On occasions this can cause bruising if the operator cannot slow the forward speed of harvester relative to the primary web speed of the harvester.

After flail & spray, however, growers often report up to 25% faster harvesting / work rates. They also comment on the choice of using a smaller tractor on the harvester or have more power available to go faster in dry conditions and keep going longer in heavy conditions. There is also less haulm trash in the tuber sample and the ability to use harvesters without picking tables and consequently less labour.

Flailing as an integral part of haulm desiccation may not always be advantageous. If the soil is very dry, flailing can dislodge soil and cause more green tubers. In heavy soils, flailing will cause more trafficking in the crop and if wet, wheeling damage can cause problems at harvest.

Best practice with flail operation

It is worth taking the time to set up the flail correctly as poor flailing leads to poor desiccation. Stems should be flailed to 15-20 cm, removing as much leaf as possible with no debris left on top of the beds or ridges. One of the key criteria of a flail is to 'chop' the green material as finely as possible. The photo shows flailed haulm placed in the furrow bottom with stems clear of debris allowing good contact for the desiccant. The shear bar on the KS6000 allows the blades to chop the material once they have removed it from the plant. The latest machines follow ridges more closely and avoid masking the stem spray target with cut haulm.



Deflectors direct the chopped material away from the plant stem left in the row. This is important if spraying is planned after flailing. The choice on whether to use deflectors or side discharge is governed by bed width. For 1.8 m beds, row or bed deflectors are suggested but for 2.0 m beds side discharge is the preferred option. Placing the material between the ridges allows good chemical contact onto the stems. Flailed material in the wheeling is not to everyone's liking, especially in a wet autumn when it can make traction on the harvester tractor more difficult. This is a much bigger problem where the harvester does not have land drive.

The nozzle location when chemical is being applied as an integrated flail and spray operation is critical in order to obtain good coverage of the stem. Experience has shown that for crops planted in rows this is inside the deflectors, within the flail hood so that chemical is applied directly to the standing stem of the crop. For potatoes planted in beds the preferred position for the spray bar is behind the flail unit. Deflectors in the hood ensure the cut material is placed in the wheelings. Purpose-built sprayer hoods shield the nozzles from the wind created by the flails, and direct the spray onto the standing stem of the plant.



Unless the sprayer is integral to the flail, it is vital to leave several days before chemical application. The updraft created by a flail very close to the ground can suck up sand and soil particles that stick to the damp stem. If this is sprayed in the same operation then the desiccant will be more likely to permeate the wet soil particles and achieve the desired level of haulm death. If, however, the spraying is done later when the soil has dried, the stems are effectively masked and are not fully exposed to the chemical desiccant. In this circumstance desiccation may be impaired. The adjacent photo shows haulm on top of the ridges leading to poor coverage of the chemical on the stems and increasing the potential for regrowth.

Haulm destruction and tuber damage

For some varieties, rapidly defoliating crops with a vigorous canopy and high soil moisture deficit can result in higher levels of bruising several weeks later at harvest. Small changes in tissue elasticity arising from the loss of tuber turgor can have a very large effect on bruising thresholds. The problem is that roots die off earlier than the crop canopy, so tubers may be unable to re-hydrate at this stage and will be susceptible to bruising even if the soil is moist at harvest.

Haulm destruction is sometimes associated with heel-end discoloration of tubers. This is evident when the heel-end of the tuber is cut across as a brown staining within the vascular ring. The problem is most common if the haulm is destroyed when very immature - irrespective of the method of destruction used. There is also evidence that the shock of rapid defoliation by flail or desiccant can let in secondary pathogens such as Dry rot due to a surge in the release of biochemical triggers within the plant. The conditions that

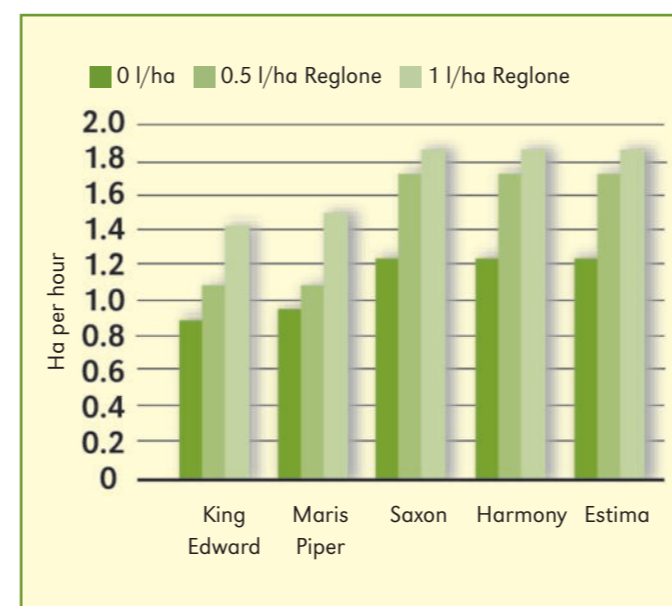
make a crop more prone to bruising appear also to induce vascular browning.

Under normal conditions tubers are likely to be more fully hydrated first thing in the morning, so crops that are mechanically or chemically defoliated at this time when the tubers are more turgid will be less at risk from bruising and vascular browning.

Other causes of vascular staining include Verticillium wilt, heat stress associated with high SMD and high levels of free-living nematodes in the soil affecting the operational efficiency of the roots.

Speed of operation

Three bed flails are now commonplace with a work rate of up to 25ha per day depending on haulm density and maturity of the crop. There is also the option to combine the flailing operation with ridge rolling to reduce green tubers caused by soil cracking. Investigations at Scottish Agronomy Ltd have shown that spraying Reglone a week before flailing can speed up the task of flailing, minimise the risk of vascular browning in dry soil conditions and save money.



Pre-treatment with Reglone can be carried out as part of the Blight spray programme. Limiting the first application to 1.0 l/ha, also allows the use of Reglone in dry soil conditions. Application of an initial low dose of Reglone to commence senescence followed by flailing or a main dose (T2) of Reglone, Spotlight Plus or Harvest has always minimised symptoms of vascular browning.

The trials found that Reglone at 0.5 litres/ha and 1.0 litre/ha pre-flailing boosted work rates by 31% and 52%, and cut fuel costs by 24% and 34% respectively. Applying the higher rate is suggested on varieties with dense haulm such as King Edward and Maris Piper. A two-pass acid programme costs typically about £90/ha, by contrast flailing followed by a spray works out at about £70-80/ha with pre-treatment reducing that by a further £7/ha.

Crops for processing

Where crops are destined for processing, the processor may have their own protocol for haulm destruction based on their requirements for tuber size, maturity and quality and other marketing factors. This is best discussed with the customer before haulm destruction.

Crops for seed

Concerns about spreading disease have been reduced with modern flail units. Spray aerosols produced by mechanical destruction of fresh haulm by flailing, however, particularly in moist conditions, can spread bacteria that cause Blackleg within the crop and between neighbouring crops. Depending on conditions there is also a risk that it can spread Blight. As such, flailing should only be undertaken within seed crops in dry conditions.

Combination of physical and chemical control

Flailing is often combined with chemical control where crop canopy is dense and poor penetration of the desiccant is expected, then flailing can be carried out to improve penetration. Depending on the crop, lower dose rates of the desiccant may be able to be used.

For salads and vigorous haulm of indeterminate main crop varieties, one robust solution is to pre-treat with 1.0l/ha Reglone followed after 5-7 days by flailing in combination or sequence with 1.0 l/ha Spotlight Plus. Spotlight Plus is ideally suited as a T2 product due to its positive effect on stem desiccation and on preventing regrowth.

Chemical destruction

There are four chemical desiccants commonly used in conjunction with flailing; sulphuric acid, diquat, carfentrazone and glufosinate-ammonium.

Acid	
Strengths	Weaknesses
<ul style="list-style-type: none"> • Rapid action • No soil moisture restrictions • Flexible rates • No residue • Rainfast • Blight control 	<ul style="list-style-type: none"> • Public perception • Protocol issues, 400 litre/ha maximum • Contractor applied • a.i. volume • Treat as LERAP B - 6m no spray zones • COSHH • Environmental profile • Haulm not brittle • Cost

Diquat (Reglone)

Enhanced vascular browning very rarely occurs in crops that are senescing at time of desiccation and even very high doses of Reglone will not exacerbate tuber symptoms in well senesced crops. Over the last five years a Reglone split application technique has been developed, which commences with an initial low dose (0.5-1.5 l/ha) to start crop senescence and open up the canopy. Flailing or alternatively a second application of Reglone up to 4.0 l/ha (maximum total dose per crop of 5.0 litres per ha) is applied once the leaves have "dropped" and haulm senescence commenced. This not only improves haulm desiccation, but also significantly reduces any levels of vascular browning if they occur. Even in conditions of high soil moisture stress where the field would fail a SMART test, providing Reglone does not exceed 1.0 l/ha the levels of browning observed are usually less than that obtained with e.g. flailing/acid. After several years of trial and field experience there is a lot of evidence that split-dose Reglone presents no greater risk to final tuber quality than any other method, even in conditions of high soil moisture deficit.

Diquat (Reglone)	
Strengths	Weaknesses
<ul style="list-style-type: none"> • Rapid action in the majority of conditions • Flexible individual application rates up to 4 litres/ha • New total dose of 5.0 litres/ha approved • Flail combination recommendation allows use in all soil conditions • No longer soil moisture restrictions for split-dose. Can apply in wet and dry soil conditions • No water buffer zone restriction • All crops & haulm stages • Rainfast in 15 minutes • Can be tank mixed with Shirlan and Sipcarn C50 • Some foliar Blight activity • No harvest interval • Cost 	<ul style="list-style-type: none"> • Vascular browning in dry conditions but only at higher rates • Haulm regrowth at lower rates • Higher rate of a.i. • Cannot be tank-mixed with Ranman TP

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The Potato Year

