Chafer Liquid Fertilizers

Profit from Placement

Potato Placement

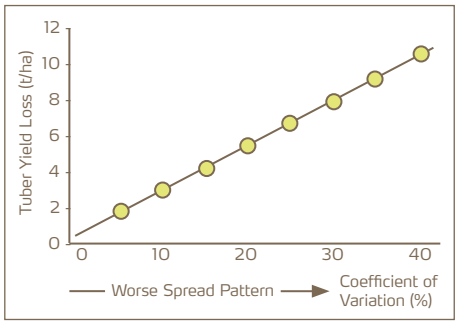
During the last 30 years the Yara Chafer liquid fertilizer placement technique has become accepted as best practice by the UK's leading growers. A controlled supply of nutrient produces both increases in marketable yield and a more even sample size.

Unbeatable Accuracy

Reduced CV

Fertilizer can be very accurately applied using placement and achieve a coefficient of variation (CV%) of less than 5%.

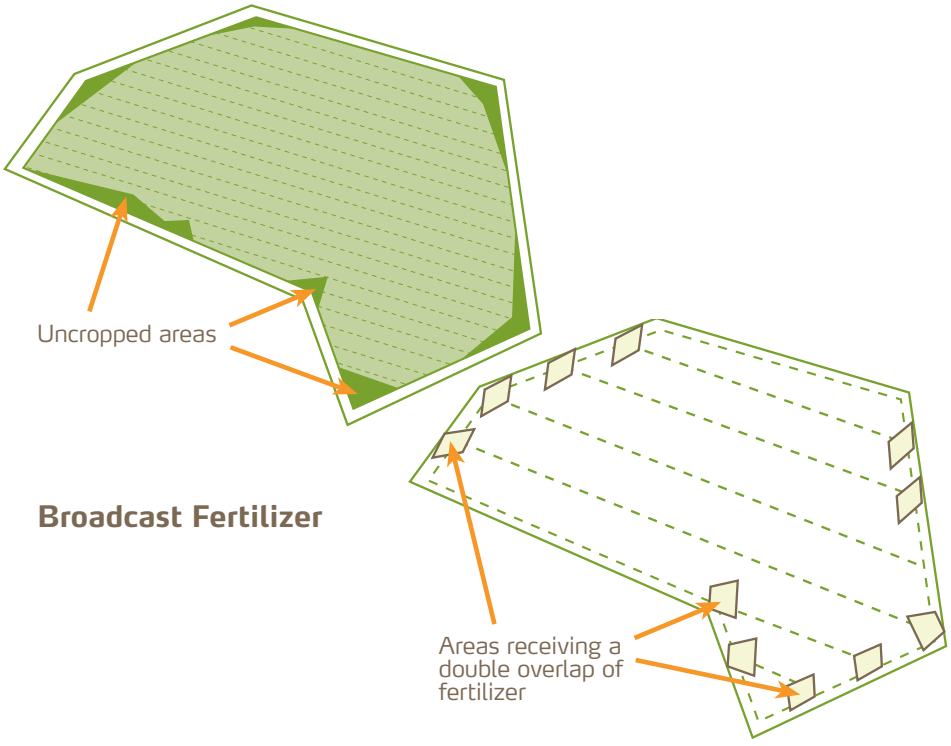
The CV of broadcast applications is typically 10-15% when carried out properly. Therefore placement of fertilizer provides greater accuracy to achieve the target nutrient rates advised by your potato agronomist.



Fertilizer is only applied to cropped areas with no overlaps

3-7% of a potato field is NOT planted to allow for harvesting, irrigation and spraying headlands; whilst 3-5% receives a double overlap when broadcasting fertilizer. Fertilizer placement at planting only places fertilizer where the crop requires it.

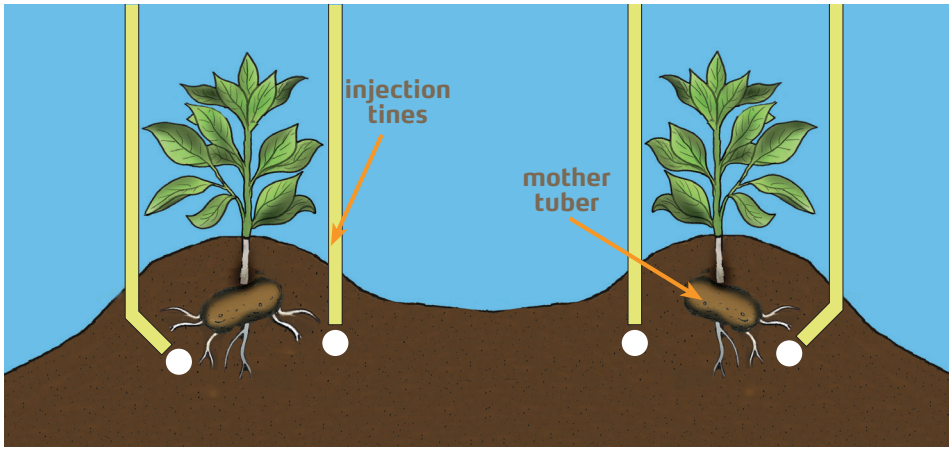
This saves fertilizer and reduces the risk of leaching of nutrients into ground water supplies. Areas being cropped will reduce the risk of leaching, particularly on irrigated land, as active plant growth will keep both nitrate and water levels in the soil at low levels during the growing season. Where fertilizer is broadcast and the actual width of planting does not match the full width of the bed, plant roots may not reach fertilized soil along the outer edges of that bed. This area of soil maybe as high as 11% of the field.



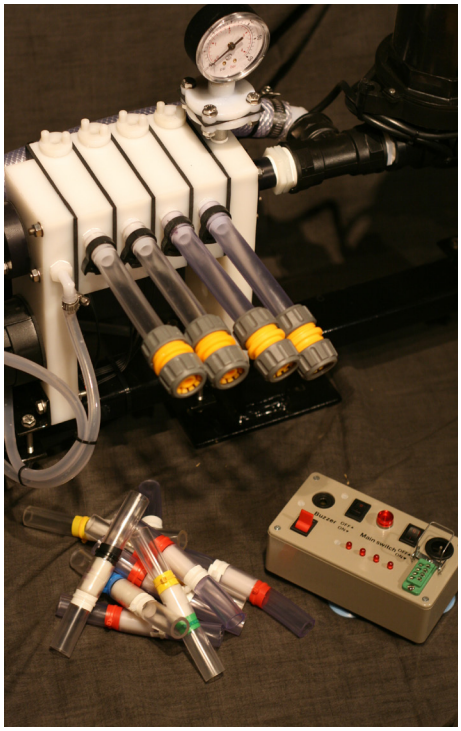
Broadcast Fertilizer

Increased Efficiency

The use of ammonium polyphosphates (used in Yara Chafer liquid fertilizers), increases the amount of phosphate available to the plant by 30% versus the use of orthophosphates. This uptake is also enhanced by local acidification. This results in a higher early growth response, leading to faster bulking. It is also known that this early response to applied phosphate increases with the amount of water soluble phosphate available to the plant. The precision placement of liquid fertilizer below the potato crop provides all of the phosphate, in the water soluble form, in a continuous band and is therefore provided in the form and in a position that allows maximum usage by the crop.



Where fertilizer is broadcast on the soil surface before planting, the mixing of the soil that occurs between fertilizer application and planting results in it being evenly distributed throughout the ridge. Some of the phosphate will inevitably be above the potato seed where it cannot be utilised. This mixing of fertilizer and soil leads to rapid "lock up" of water soluble phosphates. In contrast the placing of fertilizer at least 5cm below and to the side of the seed is a single pass operation that leads to a high concentration of phosphate and a slower "lock up"



Application Systems

Various machinery manufacturers, including Chafer Machinery, can supply and fit conversion kits enabling planters to simultaneously place liquid fertilizer while planting. Placement kits are available to fit a wide range of planter and tractor combinations.

Modern electronic rate controllers and GPS technology allows highly accurate application, with very little wastage. The increased marketable yields allow for a excellent return on capital employed.

The Yara N Sensor can now be used to map potato canopy growth by taking colour and biomass measurements. This allows identification of problem areas of the field, and the ability to track senescence for variable crop desiccation resulting in a more effective kill.

Trials Results

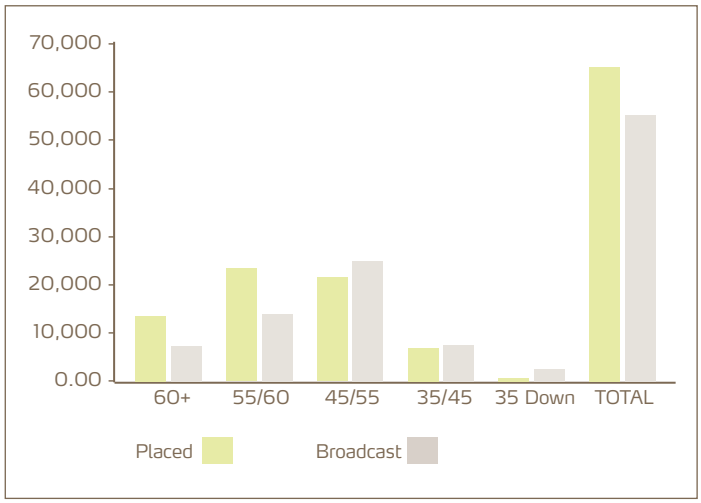
Trials carried out on behalf of Yara since the early 1990s have helped to highlight the potential yield benefits available. The Average yield increase from fertilizer placement compared to broadcast fertilizer applications was 10.1%, with increases of up to 22% being recorded.

The latest trial carried out in 2009, looking at the differences between fertilizer applications showed a 9.4% yield benefit from placement.

Trial summary (1991-2009)

Site	Year	Variety	Ware Yield (t/ha) Placed	Ware Yield (t/ha) Broadcast	% Increase
Telford	1991	Dell	59	52	13.5%
Ramsey	1992	Piper	76	63	20.6%
Northwich	1994	Piper	43	45	-4.4%
Keelby	1995	Broddick	56	47	19.1%
Flint	1995	Estima	47	52	-9.6%
Whittlesey	1995	Sante	46	44	4.5%
Telford	1995	Estima	44	36	22.2%
Whittlesey	1996	Sante	59	56	5.4%
Ormby	1996	Edward	52	53	-1.9%
Telford	1996	Dell	40	33	21.2%
Wragby	2003	Marfona	47	44	6.7%
Wragby	2005	Melody	56	48	16.0%
East Yorkshire	2007	Dell	65	55	17.3%
East Yorkshire	2009	Carlita	49	45	9.4%
Average					**10.1%**

Yield – Broadcast vs Placed (2007)



Summary

- **Increased Yield - Average of trials demonstrates 10.1% response to liquid placement**
  - Faster, earlier and uniform bulking
  - Higher seed yield
- **Unbeatable accuracy**
- **Increased Efficiency**
- **All nutrients 100% water soluble (N,P,K,S)**
- **Ammonium polyphosphate based fertilizer**
- **Prescription blending – grades can be produced to match specific requirements for any market (eg seed, ware etc)**

Feasibility Study

Benefits of Potato Placement

Potato fertilizer placement can offer many benefits, including less wasted fertilizer and increased crop yields. Trials carried out on behalf of Yara since the early 1990's shows an average yield increase from placing fertilizer of 10.1% compared to broadcast applications. In addition, 3-7% of a field is not planted and 3-5% of a field receives a double overlap when broadcasting fertilizer, therefore placement techniques can help cut down on wasted fertilizer.

Potato area grown	ha	50	Nitrogen cost	£/t	190
Average crop yield	tonnes/ha	45	Base application of nitrogen	kg/ha	100
Crop value	£/tonne	120	Width of bed	metres	1.8
Yield increase from placement	%	10.1	Width of planting	metres	1.6

Cost of Wasted Nitrogen					**Total Benefit**
Area fertilized but unplanted	%	5	2.50 ha	55.07 £/ha	£137.68
Area of fertilized overlap	%	4	2.00 ha	55.07 £/ha	£110.14
Area of bed not utilised	%	11.1%	5.56 ha	55.07 £/ha	£305.96

Yield Increase					
Increase in yield	tonnes/ha	4.55	tonnes	227.25	£27,270

Total benefit from placement - £27,824

Knowledge grows

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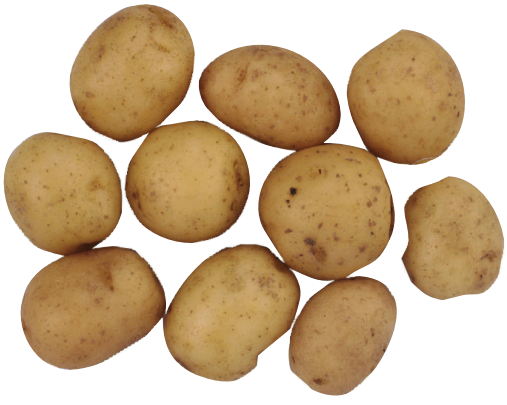
Crop Specific Grades

The Chafer liquid fertilizer production system is tremendously flexible enabling a wide variety of analyses to be produced. Yara are therefore able to supply an extensive and unrivalled range of Nitrogen and NPK solutions; many with the inclusion of sulphur. The number of grades we can supply is limitless. The number available for delivery to you today extends to over 300 different analyses.

Popular fertilizer grades for potatoes:

Suitable for pre-emergence top dressing			
Fertilizer Grade	%N	$\%K_2O$	$\%SO_3$
Chafer 19.8-0-9.4 + 5 SO_3	19.8	9.4	5
Chafer 20-0-10	20	0	10
Chafer Nuram 30.3 + 10.8 SO_3	30.3	0	10.8
Chafer Nuram 35 + 7 SO_3	35	0	7
Chafer Nuram 37	37	0	0

Suitable for foliar application		
Fertilizer Grade	%N	$\%SO_3$
Chafer Nufol 20	20	0
Chafer Nufol 20 + S	20	4.2



Suitable for placement at planting				
Fertilizer Grade	%N	$\%P_2O_5$	$\%K_2O$	$\%SO_3$
Chafer 4-12-12	4	12	12	0
Chafer 4.7-11.3-11.3 + 5 SO_3	4.7	11.3	11.3	5
Chafer 05-15-10	5	15	10	0
Chafer 6-9-12	6	9	12	0
Chafer 6.6-13.7-9.9 + 5 SO_3	6.6	13.7	9.9	5
Chafer 7-16-10	7	16	10	0
Chafer 7-21-0	7	21	0	0
Chafer 7-21-09	7	21	9	0
Chafer 8-0-12	8	0	12	0
Chafer 8-4-12	8	4	12	0
Chafer 8.5-7.5-11.3 + 5 SO_3	8.5	7.5	11.3	5
Chafer 9-9-12	9	9	12	0
Chafer 9-11-11	9	11	11	0
Chafer 9-18-09	9	18	9	0
Chafer 9-27-0 + 6 SO_3	9	27	0	6
Chafer 9.4-8.5-11.3 + 5 SO_3	9.4	8.5	11.3	5
Chafer 10-5-12	10	5	12	0
Chafer 10-15-10	10	15	10	0
Chafer 10-18-7	10	18	7	0
Chafer 10.5-12.5-10.5	10	12.5	10.5	0
Chafer 11-8-11	11	8	11	0
Chafer 11-11-11	11	11	11	0
Chafer 11.5-3-11.5	11.5	3	11.5	0
Chafer 12.2-0-11.3 + 5 SO_3	12.2	0	11.3	5
Chafer 12.5-15-9	12.5	15	9	0
Chafer 12-17-9	12	17	9	0
Chafer 12-18-0	12	18	0	0
Chafer 12-18-0 + 5 SO_3	12	18	0	5
Chafer 13-13-6.5	13	13	6.5	0
Chafer 14-17-0	14	17	0	0
Chafer 16-16-0	16	16	0	0
Chafer 18-14-0	18	14	0	0
Chafer 20-10-0	20	10	0	0