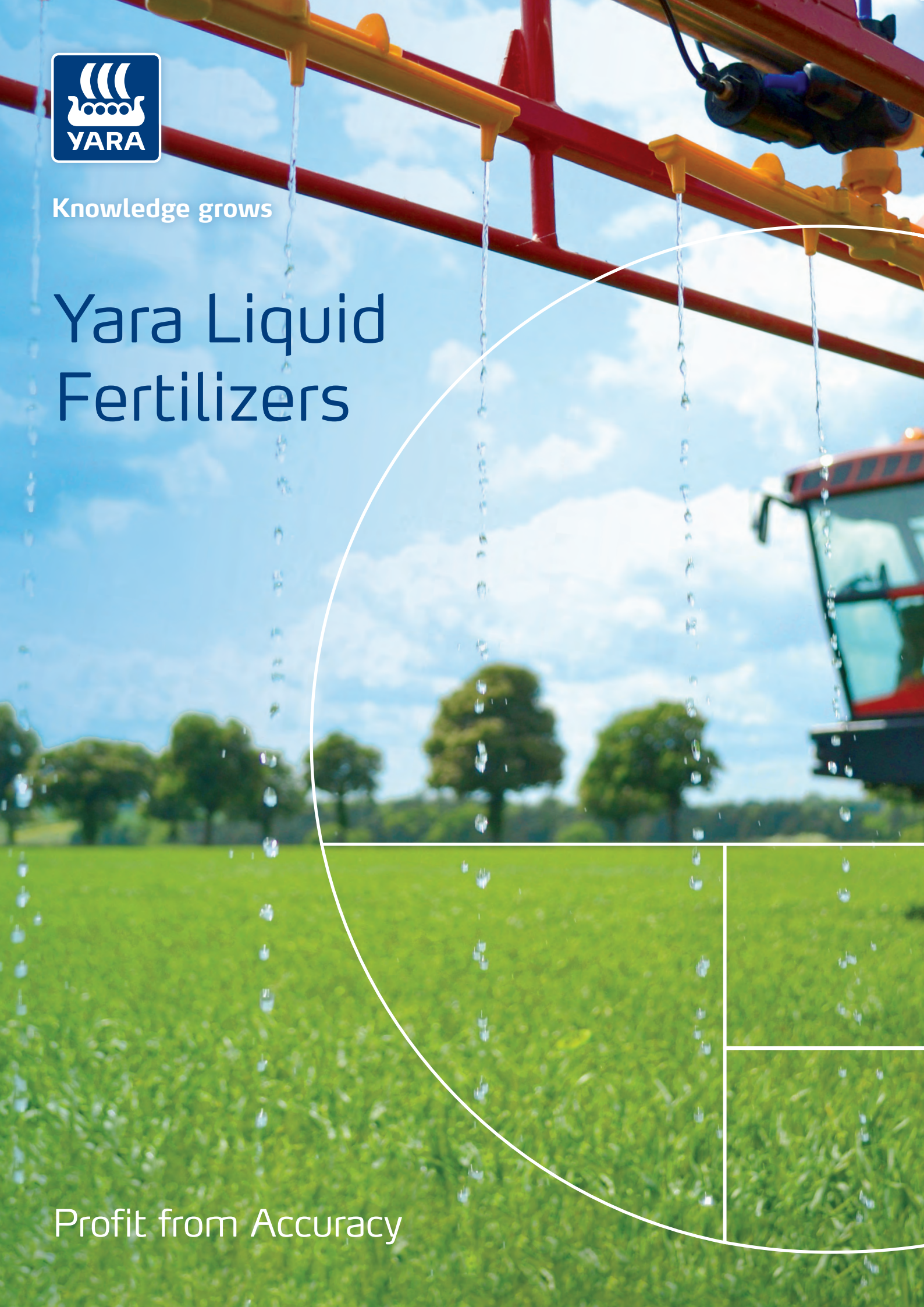


Knowledge grows

Yara Liquid Fertilizers

Profit from Accuracy

Precision and Profit from Yara Liquid Fertilizers

Fast and Accurate

Many of the country's leading farmers continue to move to liquid fertilizer systems. As practical, innovative businessmen they recognise the substantial economic benefits to be gained by applying fertilizer quickly and accurately. With 36 metre booms now allowing crops to be treated accurately at rates of 1 hectare every 60 seconds, the rewards are obvious.

No Wastage

From both environmental and financial aspects, liquid fertilizer's ability to be applied precisely up to the field margin without wastage or contamination of hedgerows and waterways is of increasing importance to maintain good farming practice. The problems and costs associated with the disposal of fertilizer bags are also eliminated.

Simple

Moving to a liquid fertilizer system is both easy and inexpensive. Your farm sprayer can be converted within minutes – just as long as it takes to change a set of jets. Yara will supply storage tanks appropriate for your farm's requirements and these can be installed quickly and easily. In fact, you could be applying Yara's liquid fertilizer within days of making the decision to 'go liquid'.

The Key to Profitability

Unbeatable Accuracy

Liquid fertilizer applied through your current farm sprayer can give you an immediate improvement in the accuracy of your nitrogen and NPKS applications helping to ensure the best possible yield.

Accuracy is improved:

- Across the full boom width, however wide.
- Over the entire field, with the correct amount applied per hectare.
- At the end of bouts by reducing overlaps.
- At the field margins, by farming to maximum efficiency to the crop's edge - and no further.

Liquid fertilizer applications can produce an improvement in spreading accuracy worth £15 per ha for winter wheat when compared to solid fertilizer. If the solid fertilizer is of poor quality or spreading conditions are not ideal at wide bout widths, the financial loss can easily reach £40 per hectare.

Yara's liquid fertilizers are 100% water soluble, and hence are uniform, which means they give consistent flow rates and no recalibration is required when changing grades. Electronic rate control systems can enhance accuracy even further, and when combined with variable rate technology and individual boom section control, the accuracy is unsurpassed.

These benefits can lead to:

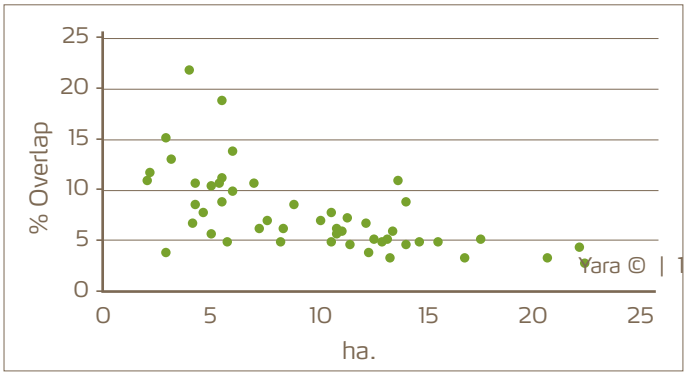
- Even crops
- Reduced overlapping on headlands
- Less fertilizer wastage
- Less risk of lodging and diseases
- Easier combining
- More consistent grain samples
- Higher yields

Boom Section Control

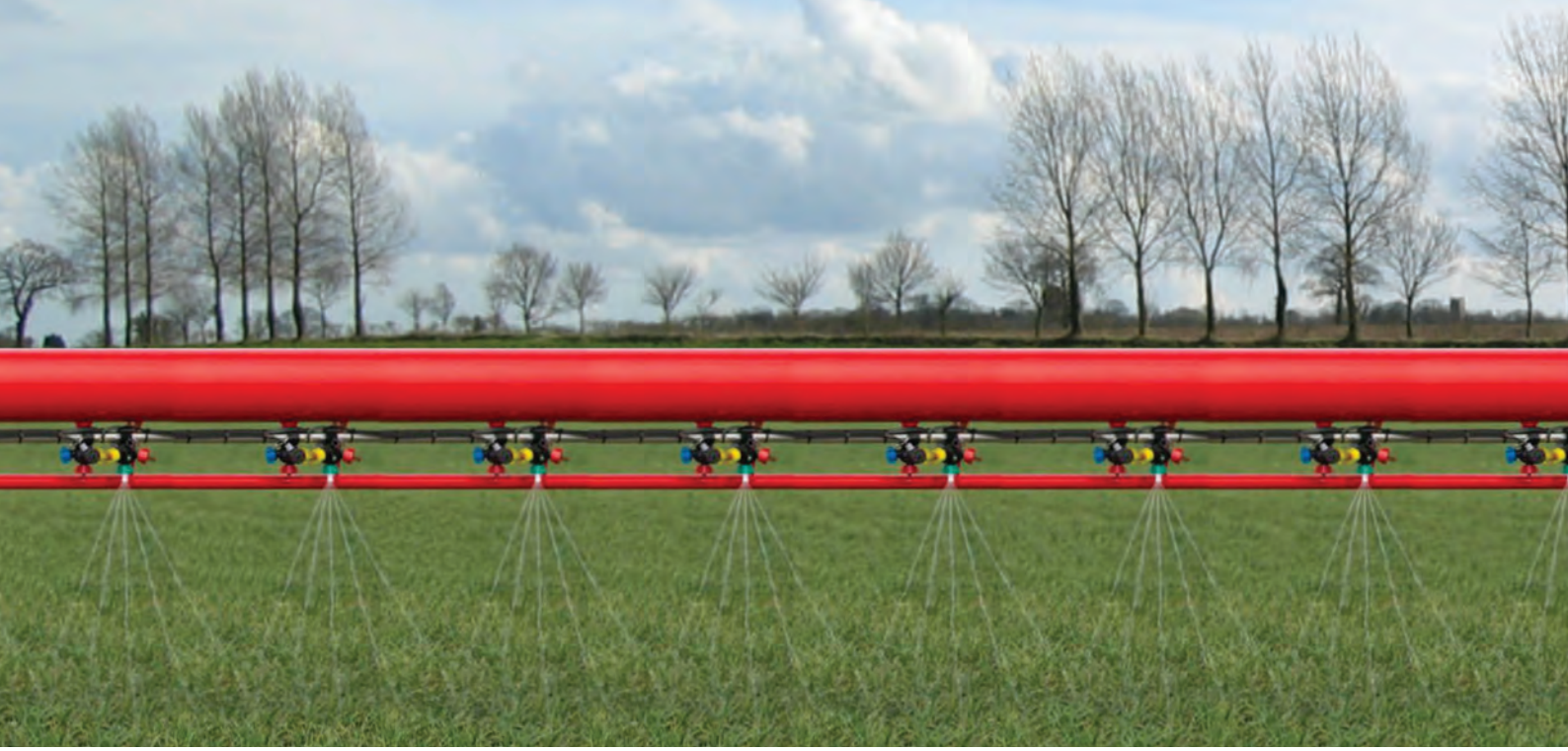
Adopting sprayer boom section control means the problem of fertilizer over-application caused by overlapping doses can be almost eliminated, resulting in more even crops and reduced lodging. This can also result in substantial fertilizer savings. The more irregular the field shape and the smaller the size, the bigger the benefit.

The following chart shows how the percentage of overlap can vary with shape and size. Fifty random fields were measured and the overlap calculated at an average of 8%.

% Overlap v Field Size ha.



Where field sizes are small or irregular, the bigger the benefit.



The Headland Effect

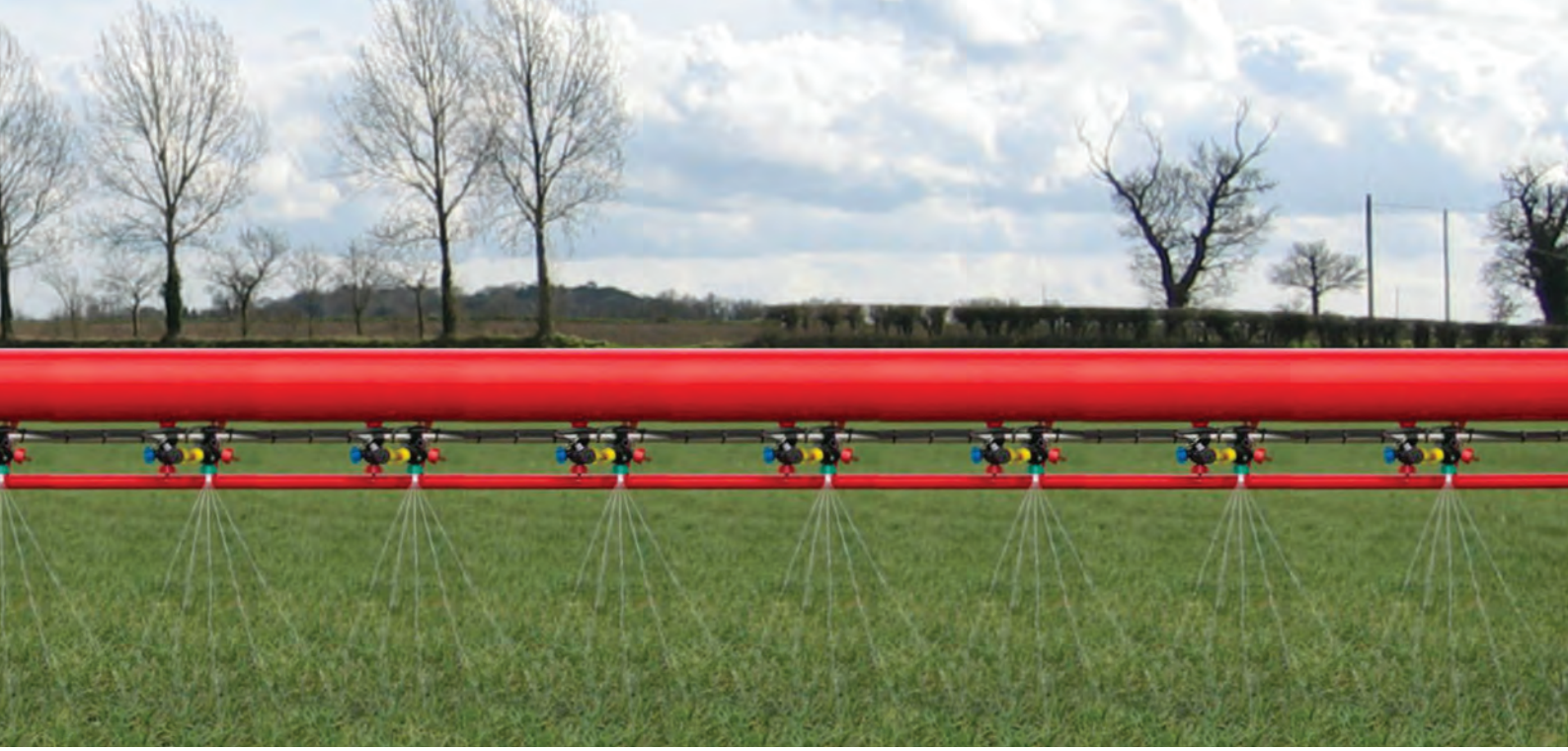
Liquid fertilizer applied through stream jets fertilizes to the edge of the crop and no further.

- Under-fertilizing crop margins has been calculated to give up to 34% yield loss in the last 3 metres of crops, averaging over the whole headland as much as 5%.
- Over-fertilizing i.e applying past the crop edge into hedgerows or on to roads, wastes up to 5% of total fertilizer applied to the field.
- Spraying up to the crop edge also protects the environment and field margins under management schemes.

Headland Area Yield Loss

This table demonstrates the losses that can be avoided from suboptimal yields on headlands.

Headland area		
Total arable	ha	600
No. of fields	no.	40
Tramline width	m	24
Average field size	ha	15.00
Headland area per field	ha	3.49
Headland area over farm	ha	139.51
Headland area	%	23%
Headland yield loss		
Target yield	t/ha	9
Headland yield loss	%	5%
Yield loss per field	t	1.67
Final Impact		
Price per tonne (grain)	£	120
Total loss in tonnes	t	66.93
Total value of loss		**£8,031**



More Working Days

Liquid fertilizers can mean more available spreading days because, compared to solid fertilizers, applications are less affected by weather conditions.

- Applications can be made on damp days and even rainy days.
- Spread patterns are less affected by the wind.

Switching to liquids and increasing work rates produces real benefits:

- Timely drilling / spraying.
- Reduction in machinery / fuel / labour costs.
- Quick, effective treatment of the crop at the correct growth stage.
- Efficient utilization of inputs.

For example, several years ago the move from 12 to 24 metre bout widths reduced the time taken to cover 1 hectare by over 40%. On a 1000 hectare farm, the time spent applying fertilizer and agrochemicals was reduced by some 160 hours through adoption of 24 metre tramlines.

Wider bout widths also effectively increase the area cropped. The wheelings caused by spreading fertilizer at 12 metres, even on standard width tyres, cover a minimum of 5% of the cropped area. The move to 24 metres reduced this area to 2.5%, resulting in an increase in yield. On the same 1000 hectare farm, this translated to an additional wheat value of over 200 tonnes production.

Needless to say, the financial benefits are greater for farms adopting 36, 40 and 48 metre systems. Liquid fertilizers can also be tank mixed with some agrochemicals, further reducing spraying time and increasing efficiency.

This chart demonstrates the increase in efficiency obtained by upgrading fertilizer application systems. It starts with a 'present system' of a 2 tonne capacity solid fertilizer spreader with a bout width of 18 metres and works through various upgrade options. The fourth option is a modern 4000 litre capacity sprayer with a 36 metre boom width. These are routine examples only, Yara's liquid fertilizer sales staff are able to calculate your own 'tailor made' system comparison.

Typical Systems Comparison

Detail		Present system	Proposed systems		
		1	2	3	4
Total crop	ha	1000.00	1000.00	1000.00	1000.00
Tank capacity	lt/kg	2000.00	2500.00	3000.00	4000.00
Application rate	lt kg/ha	200.00	200.00	200.00	200.00
Fill time	min	5.00	6.00	7.00	10.00
Application speed	kph	12.00	12.00	15.00	15.00
Boom width	m	18.00	24.00	24.00	36.00
Travel time	min	10.00	10.00	10.00	10.00
Hectares / Hour		**9.65**	**12.36**	**14.92**	**20.09**
Total Hours		**103.00**	**80.00**	**67.00**	**49.00**

Increased Efficiency

The following factors mean that more acres are covered each working day:

- Modern liquid fertilizer systems are capable of achieving extremely high work rates.
- The use of maximum bout widths, now typically 36 metres and rising, means fewer passes.
- Sophisticated boom systems allow for increased ground speed.
- Rapid fertilizer handling and tank filling means less standing time

Reduced Labour

The handling and application of liquid fertilizer is often a simple, one man operation - at the delivery stage, no farm labour is required as the tanker driver will off-load directly into the farm storage tank. The transfer of fertilizer from storage tank to sprayer is very rapid (typically at the rate of 450 litres/minute). A quicker and much more efficient operation than lifting and splitting bags.

These factors, when combined with increased work rates, can release labour for other farm operations during the busiest times of the farming calendar. The system is very flexible and can be easily optimised according to the farm's topography, labour profile and working practices.

Better Use of Capital

Changing to liquid fertilizers can have a considerable effect on the capital requirements of a farming enterprise:

- One machine often replaces two.
- Most farm sprayers can be converted at relatively little cost to apply liquid fertilizers, and a spreader is not required.
- Alternatively, where two sprayers are required, both fertilizing and spraying capacities are effectively doubled.

Handling Equipment

Liquid fertilizers are delivered directly into farm storage tanks and simply pumped into the sprayer. On some farms this means that solid fertilizer handling equipment can be completely dispensed with.

Storage

Buildings are no longer required for fertilizer storage and can therefore be released, thus increasing grain storage and marketing options, or providing covered storage for vehicles or non agricultural revenue earning purposes such as warehousing or storage.

Easier Deliveries to Farm

- Purpose made tanks to Yara specification.
- Deliveries off-loaded by Yara driver.
- No farm labour required.
- No forklift needed.
- Exact quantities can be transferred, no partly-used bags.
- No more inconvenient delivery times.

Reduced Storage

- Release farm buildings for other use - possible alternative income.
- No split bags - reduces waste.
- No bag disposal - direct cost saving.

One Man Loading

- One man operation.
- Sprayer links directly to storage tank.
- No forklift or bag handler.
- No trailer.
- No second tractor.
- Fast fill pump transfers product, no physical handling.
- Sprayer can refill centrally, or at tanks spread across the farm, or fed by bowser.

Meeting the Crop's Nutrient Requirements

Yara's liquid fertilizer production system is tremendously flexible enabling a wide range of analyses under the brand name Chafer™ to be produced.

Yara is therefore able to supply an extensive and unrivalled range of Nitrogen and NPK solutions; many with the inclusion of sulphur (see following page).

Balanced Nitrogen Supply

Most of the straight nitrogen used on UK farms is supplied as ammonium nitrate, with some as urea. Each form of nitrogen behaves slightly differently in the soil and releases nitrogen to the crop at different rates. Nitrogen in its nitrate form is available for rapid uptake by the crop. In its ammonium and ureic forms, nitrogen is released more slowly, thereby extending the availability of nitrogen to the crop over a longer period.

Chafer Nuram, Yara's liquid nitrogen fertilizer, combines these two sources of nitrogen to produce a unique solution with 'balanced' release properties. Although primarily soil applied, the range also includes grades suitable for foliar applications and precision placement on salad and vegetable crops.

Prescription Blending

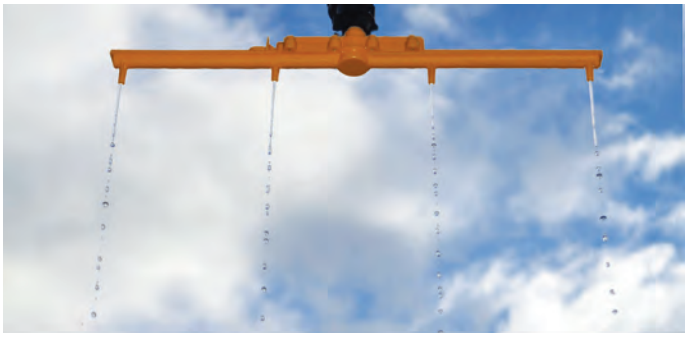
Where required, grades can be produced to meet the specific nutrient requirements of individual crops. This is particularly relevant to many root crops and also to applications of N, P and K to standing crops in the spring. Similarly, where sulphur is a limiting factor to crop yield, numerous N:S ratio products are available to match the farm requirement.

Trace Elements

A range of YaraVita trace elements are tank-mixable with some of our liquid fertilizers allowing for reduced passes through the crop.

For further details please contact your local Yara Area Manager or visit www.tankmix.com

Yara's liquid fertilizer production - Elvington


Stream bars

Yara Liquid Fertilizer Grades

The number of Chafer™ grades we can supply is limitless. The number available for delivery to you today extends to over 300 different analyses. The main N+S range and examples of our NPK+S grades are listed below.

Main N+S Range

Fertilizer Grade	%N	$\%SO_3$
Chafer Nuram 37	37	0
Chafer Nuram 35+S	35	7
Chafer N32+9.4 SO_3	32	9.4
Chafer N30.3+10.8 SO_3	30.3	10.8
Chafer N29+11.9 SO_3	29	11.9
Chafer N25+14.3 SO_3	25	14.3
Chafer N19+19 SO_3	19	19

Foliar Applied N

Fertilizer Grade	%N	$\%SO_3$
Chafer Nufol 20	20	0
Chafer Nufol+S	20	4.2

Yara's liquid fertilizer production - Chedburgh

Examples of NPK+S Range

Fertilizer Grade	%N	$\%P_2O_5$	$\%K_2O$	$\%SO_3$
Chafer 20-10-0+S	20	10	0	5
Chafer 20-0-10	20	0	10	
Chafer 19.8-0-9.4+S	19.8	0	9.4	5
Chafer 19-4-4	19	4	4	
Chafer 18-27-0	18	27	0	
Chafer 18-9-9	18	9	9	
Chafer 18-6-9	18	6	9	
Chafer 17.9-5.6-8.5+S	17.9	5.6	8.5	5
Chafer 17-0-11	17	0	11	
Chafer 16-16-0	16	16	0	
Chafer 16-3-10	16	3	10	
Chafer 14-10-10	14	10	10	
Chafer 12-18-0	12	18	0	
Chafer 12.2-0-11.3+S	12.2	0	11.3	5
Chafer 12-0-12	12	0	12	
Chafer 11-11-11	11	11	11	
Chafer 11-10.3-10.3+S	11	10.3	10.3	5
Chafer 10-15-10	10	15	10	
Chafer 10-5-12	10	5	12	
Chafer 9-18-9	9	18	9	
Chafer 9-9-12	9	9	12	
Chafer 8.5-7.5-11.3+S	8.5	7.5	11.3	5
Chafer 8-24-0	8	24	0	
Chafer 8-14-10	8	14	10	
Chafer 7-21-9	7	21	9	
Chafer 7-16-10	7	16	10	
Chafer 6-11-12	6	11	12	
Chafer 6-9-12	6	9	12	
Chafer 5-15-10	5	15	10	
Chafer 4.7-11.3-11.3+S	4.7	11.3	11.3	5
Chafer 4-12-12	4	12	12	
Chafer 4-4-12	4	4	12	
Chafer 2-7-14	2	7	14	

Main Nitrogen Range - Application Rate Guide

Application Rate	Chafer NURAM 37	Chafer NURAM 35+S		Chafer N32 + 9.4 SO_3		Chafer N30.3 + 10.8 SO_3		Chafer N29 + 11.9 SO_3		Chafer N25 + 14.3 SO_3		Chafer N19 + 19 SO_3		Chafer NUFOL 20	Chafer NUFOL 20+S	
Litres/ha	kg/ha	kg/ha		kg/ha		kg/ha		kg/ha		kg/ha		kg/ha		kg/ha	kg/ha	
	N	N	SO_3	N	SO_3	N	SO_3	N	SO_3	N	SO_3	N	SO_3	N	N	SO_3
50	19	18	4	16	5	15	5	15	6	13	7	10	10	10	10	2
75	28	26	5	24	7	23	8	22	9	19	11	14	14	15	15	3
100	**37**	**35**	**7**	**32**	**9**	**30**	**11**	**29**	**12**	25	14	**19**	**19**	**20**	**20**	**4**
125	46	44	9	40	12	38	14	36	15	31	18	24	24	25	25	5
150	56	53	11	48	14	45	16	44	18	38	21	29	29	30	30	6
175	65	61	12	56	16	53	19	51	21	44	25	33	33	35	35	7
200	74	70	14	64	19	61	22	58	24	50	29	38	38	40	40	8
225	83	79	16	72	21	68	24	65	27	56	32	43	43	45	45	9
250	93	88	18	80	24	76	27	73	30	63	36	48	48	50	50	11
275	102	96	19	88	26	83	30	80	33	69	39	52	52	55	55	12
300	111	105	21	96	28	91	32	87	36	75	43	57	57	60	60	13
325	120	114	23	104	31	98	35	94	39	81	46	62	62	65	65	14
350	130	123	25	112	33	106	38	102	42	88	50	67	67	70	70	15
375	139	131	26	120	35	114	41	109	45	94	54	71	71	75	75	16
400	148	140	28	128	38	121	43	116	48	100	57	76	76	80	80	17
425	157	149	30	136	40	129	46	123	51	106	61	81	81	85	85	18
450	167	158	32	144	42	136	49	131	54	113	64	86	86	90	90	19
475	176	166	33	152	45	144	51	138	57	119	68	90	90	95	95	20
500	185	175	35	160	47	152	54	145	60	125	72	95	95	100	100	21
525	194	184	37	168	49	159	57	152	62	131	75	100	100	105	105	22
550	204	193	39	176	52	167	59	160	65	138	79	105	105	110	110	23
575	213	201	40	184	54	174	62	167	68	144	82	109	109	115	115	24
600	222	210	42	192	56	182	65	174	71	150	86	114	114	120	120	25
625	231	219	44	200	59	189	68	181	74	156	89	119	119	125	125	26
650	241	228	46	208	61	197	70	189	77	163	93	124	124	130	130	27
675	250	236	47	216	63	205	73	196	80	169	97	128	128	135	135	28
700	259	245	49	224	66	212	76	203	83	175	100	133	133	140	140	29
725	268	254	51	232	68	220	78	210	86	181	104	138	138	145	145	30
750	278	263	53	240	71	227	81	218	89	188	107	143	143	150	150	32
775	287	271	54	248	73	235	84	225	92	194	111	147	147	155	155	33
800	296	280	56	256	75	242	86	232	95	200	114	152	152	160	160	34
825	305	289	58	264	78	250	89	239	98	206	118	157	157	165	165	35
850	315	298	60	272	80	258	92	247	101	213	122	162	162	170	170	36
875	324	306	61	280	82	265	95	254	104	219	125	166	166	175	175	37
900	333	315	63	288	85	273	97	261	107	225	129	171	171	180	180	38
925	342	324	65	296	87	280	100	268	110	231	132	176	176	185	185	39
950	352	333	67	304	89	288	103	276	113	238	136	181	181	190	190	40
975	361	341	68	312	92	295	105	283	116	244	139	185	185	195	195	41
1000	370	350	70	320	94	303	108	290	119	250	143	190	190	200	200	42

Moving to Liquids

Making the change to Yara's liquid fertilizers couldn't be simpler. All that is involved is changing sprayer jets and the safe siting of storage tanks.

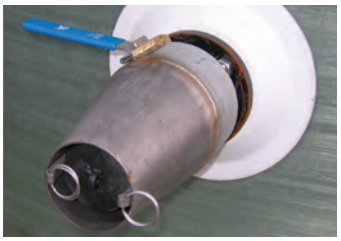
Storage Tanks

Yara recommend GRP (Glass Reinforced Plastic) tanks which we have manufactured to our own strict specifications. These tanks have provided robust, rust-free storage for over 30 years and are available in a range of sizes.

Your local Yara Area Manager will be pleased to inspect any potential site and recommend the ideal number.

For specific tank size and foundation guidelines see Yara's tank leaflet or visit www.yara.co.uk

Lockable stainless steel valves



Security cover

Quick & Easy Conversion

Yara can advise on the choice of nozzles for your sprayer depending on its make and the crops to be fertilized. 'Quick-fit' stream bars, specifically designed for top-dressing applications on arable and grass crops are widely used. These bars produce a vertical stream of liquid which is unaffected by boom height. They are extremely accurate and enable applications of nitrogen to be carried out throughout the season. Examples of stream bars and alternative designs of liquid fertilizer nozzles available from a number of manufacturers, are shown below.

UK Facilities

- Liquid fertilizer production and storage facility
- Solid fertilizer facility
- Foliar and micronutrient production and analysis facility
- UK Head Office

Yara UK Limited
Welington Road
Pocklington Industrial Estate
Pocklington, York
North Yorkshire, YO42 1DN

agronomy.uk@yara.com
www.yara.co.uk

Yara UK Limited

The Chafer™ product range of liquid fertilizers are manufactured and distributed by Yara UK limited, the UK division of the Norwegian based Yara International ASA.

Yara International's business is based on the processing of natural resources to meet the world's needs for food. In all its activities, Yara emphasises quality, the efficient use of resources and care for the environment.

Yara is the world's largest producer of agricultural fertilizers. Extensive investment in production and agronomic R&D programmes produce fertilizer products, systems and advice designed to ensure the future of good environmental and cost effective sustainable farming.

Yara UK Limited
December 2022

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