

Accurate spreading of fertilizer and manure: lessons from UK practice

Two things to get right

Deciding the amounts of nutrients
that should be applied



Applying the nutrients



Types of inaccurate spreading

(fertilizer or manure)

- Wrong rate of nutrient application
- Uneven spreading
- Spreading outside crop area (no-spread zones) or over-/under-spreading

Inaccurate spreading affects:

- Crop yield, quality and sometimes harvesting efficiency so farm economics
- Compliance with environmental regulations and codes

Accurate spreading is a requirement

- NVZ rules:

Any person spreading nitrogen fertiliser must do so in as accurate a manner as possible.

- Farming Rules for Water:

You must take reasonable precautions to reduce the risk of pollution when you apply manure or fertiliser.

Examples include:

- checking your spreading equipment is calibrated and doesn't leak

Spreading manufactured fertilizers accurately

Concentrating on solid fertilizers and mostly nitrogen

Effect of wrong amount of N applied – winter wheat

	Yield effect	Fertilizer effect	Net effect
N rate 25 kg N/ha too high	+£14/ha	-£18/ha	-£4/ha
N rate 25 kg N/ha too low	-£24/ha	+£18/ha	-£6/ha

Effect of uneven spreading of N

CV% on winter wheat	Calculated effect
0 Perfectly even spreading	£0/ha
10 Achievable	-£3/ha
20 Striping starts	-£12/ha
30 Fairly common pre-testing	-£29/ha

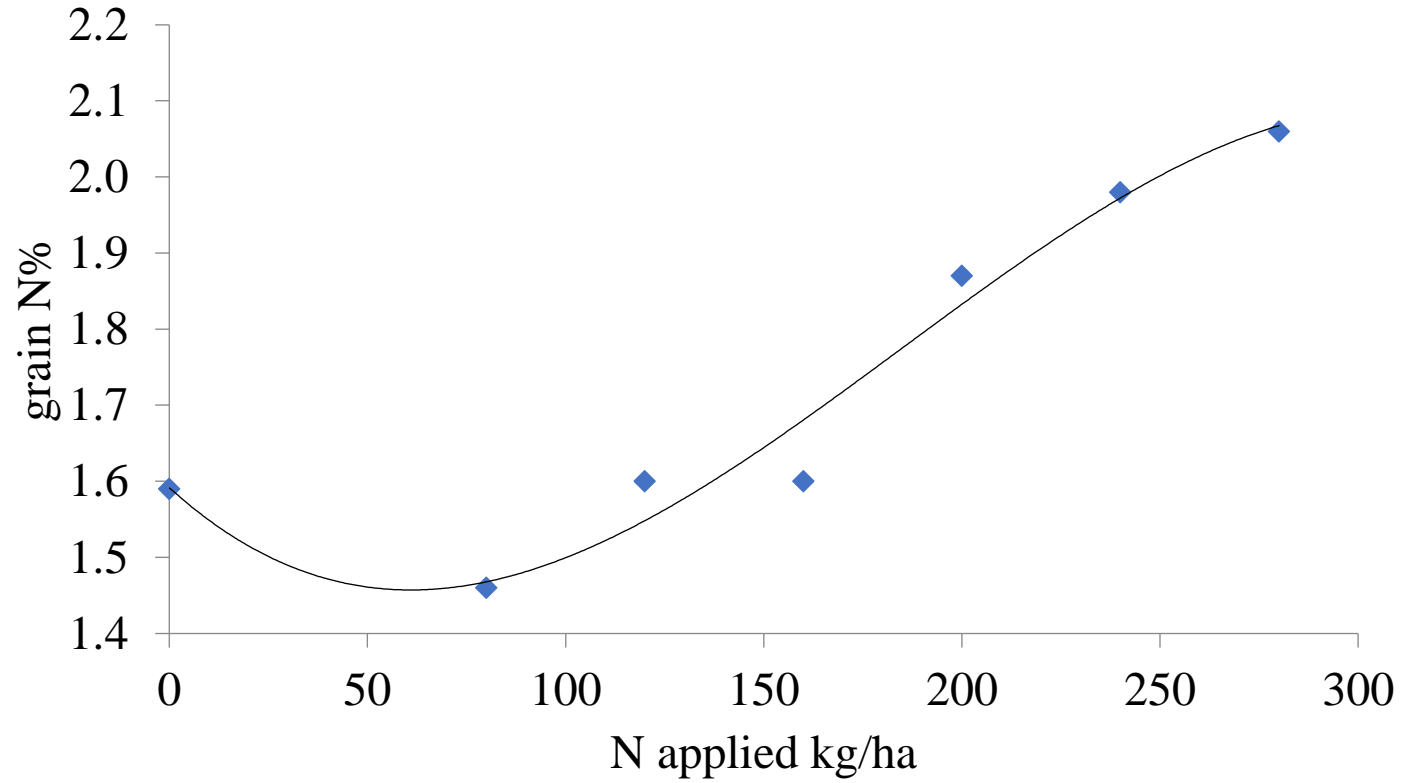




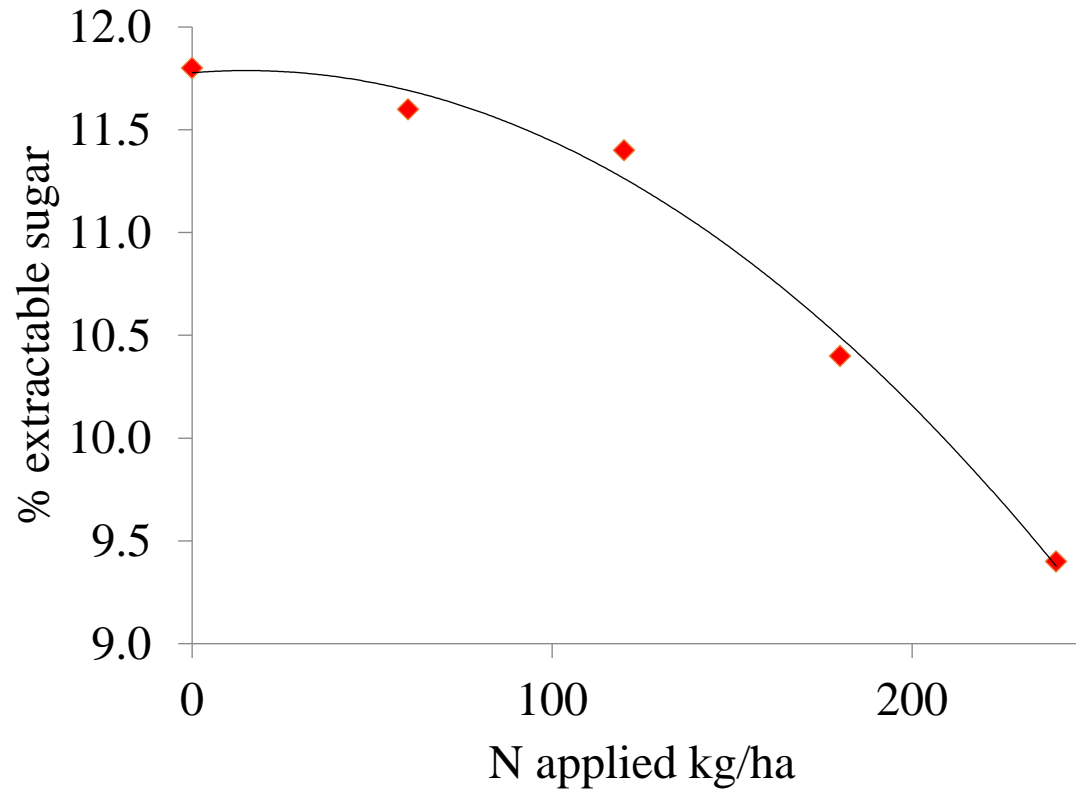


Grain %N and N applied

Winter wheat



Extractable sugar and N rate



To ensure fertilizer is spread accurately:

- Fertilizer must be of adequate physical quality
- Spreader must be in good condition
- Spreader must be calibrated for rate of application
- Spread pattern must be checked and adjusted if necessary
- Spreader must be operated properly in suitable conditions

Granular TSP



Blended 17:17:17



Damaged bag



Fertilizer physical quality

Consistent:

Particle size and size
range

Particle weight, shape
and surface

High:

Particle strength

Low:

Presence of dust and fines
Caking and lumps



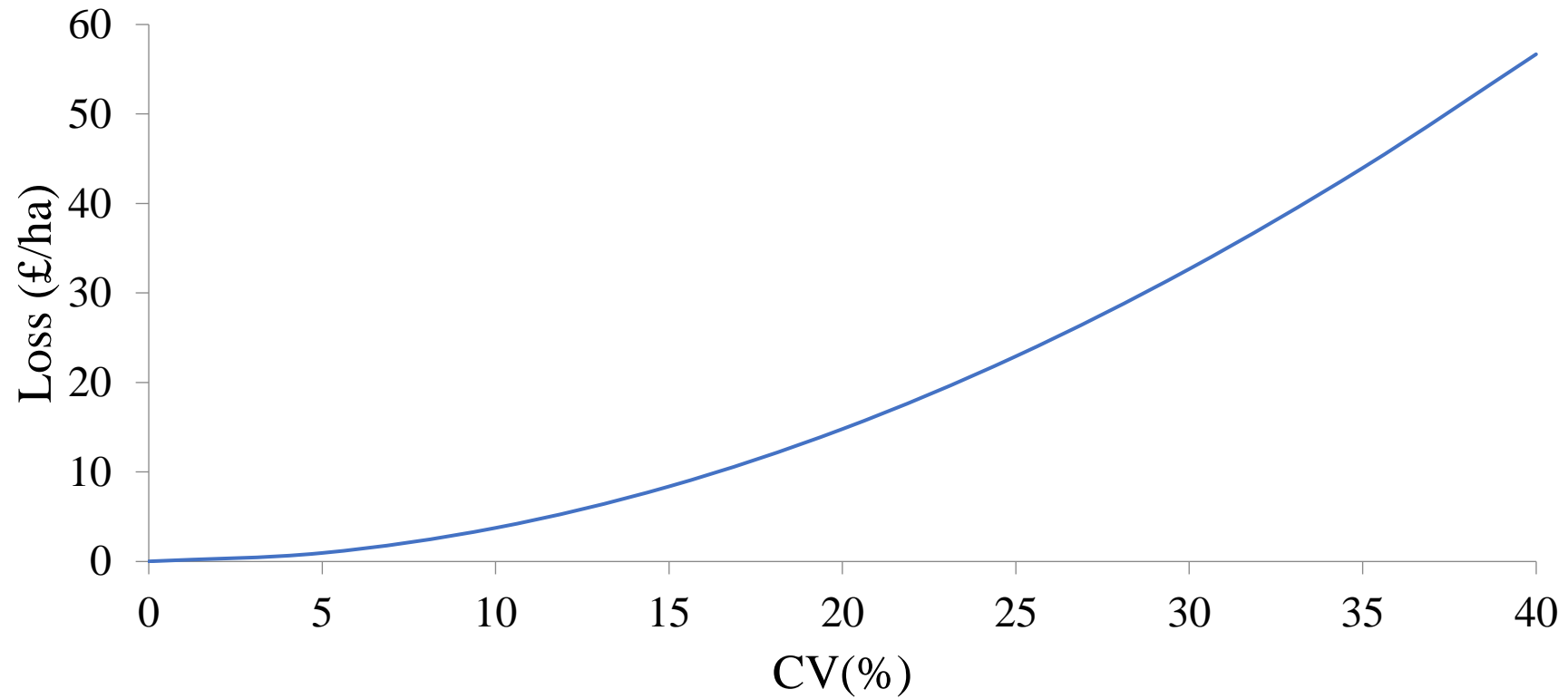
Calibration for rate of application

- Manually using weight of fertilizer in collection bucket
- Continuously using weigh cells

Tray testing for evenness of application



Financial loss at different CV (compared to CV=0)



Cost and benefit of tray testing

- Cost of professional tray testing around £250/machine
- Loss from CV of 30% against 10% around £25/ha in wheat
- Cost recovered in about 10 ha spread

National Sprayer Testing Scheme

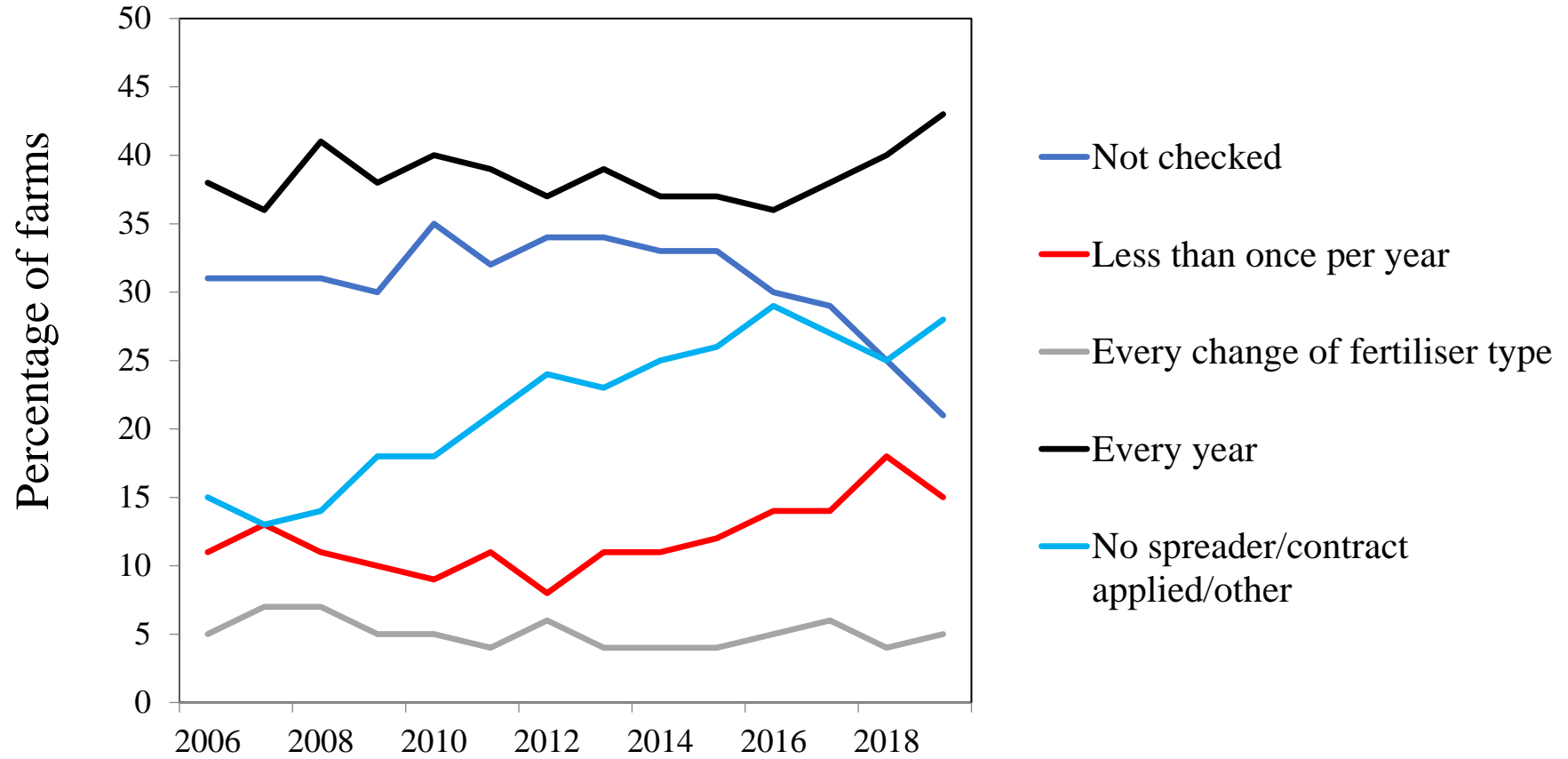
(also covers fertilizer spreaders)

Test includes:

- a) Initial inspection of the spreader including condition of discs and vanes.
- b) Tray testing to confirm evenness of spread across the working width of the machine.
- c) Adjustments made if required to achieve the best coefficient of variation (CV) for each product
- d) Electronic report of all test results

Frequency of fertilizer spreader tray-tests

(Source: BSFP)



No Spread Zones

Surface water



Hedgerows

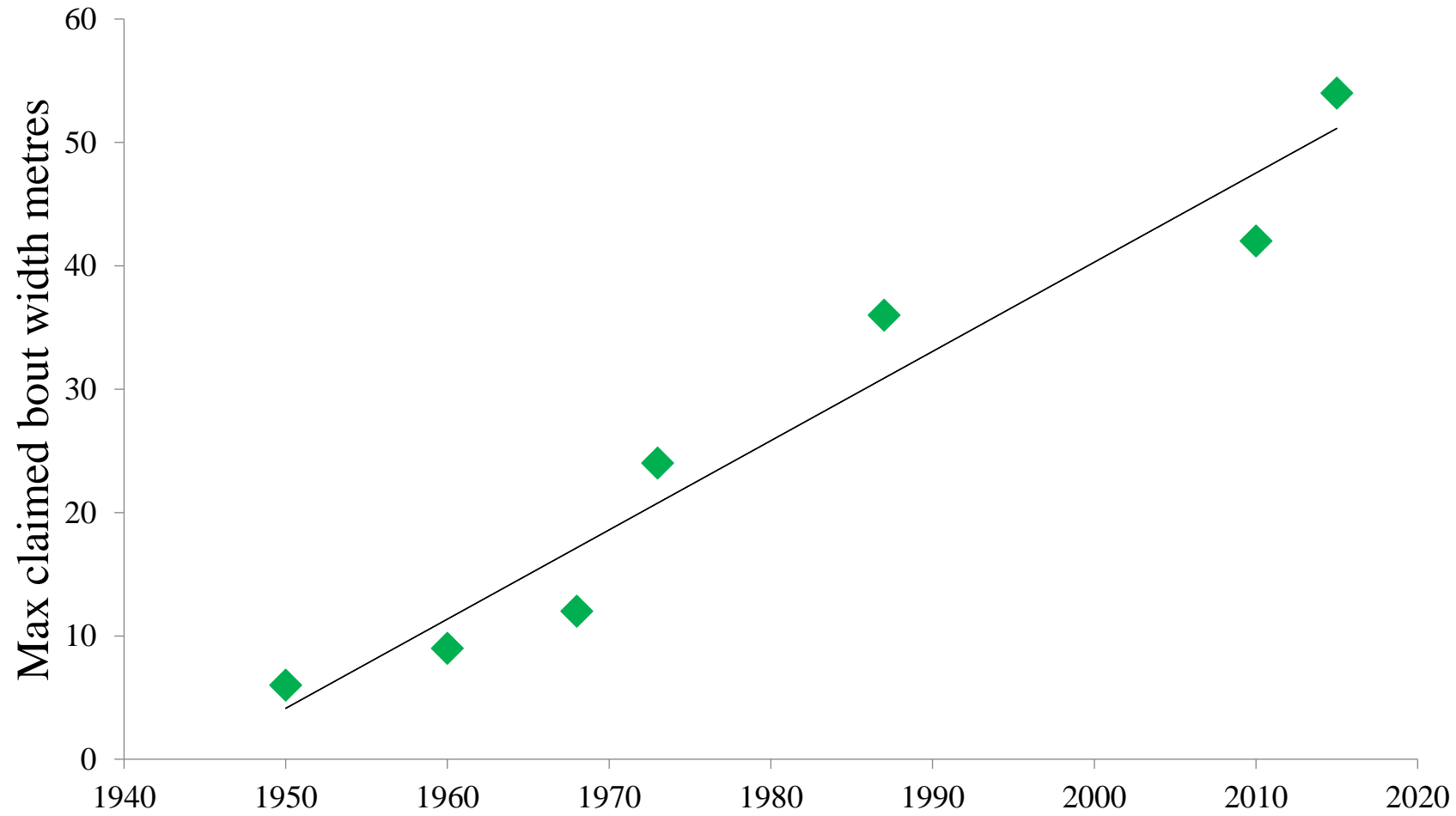


Improvements in technology





Development in claimed bout width *(Disc spreaders)*



Developments in technology

- Weigh cells and other sensors
- Actuators
- GPS
- Rate of application control during spreading
- Section control
- Spread pattern monitoring
- Crop sensors
- Variable rate via links to maps or sensors
- Uploading settings

Spreading organic manures accurately

‘Accurately’ applies to:

Amount of material

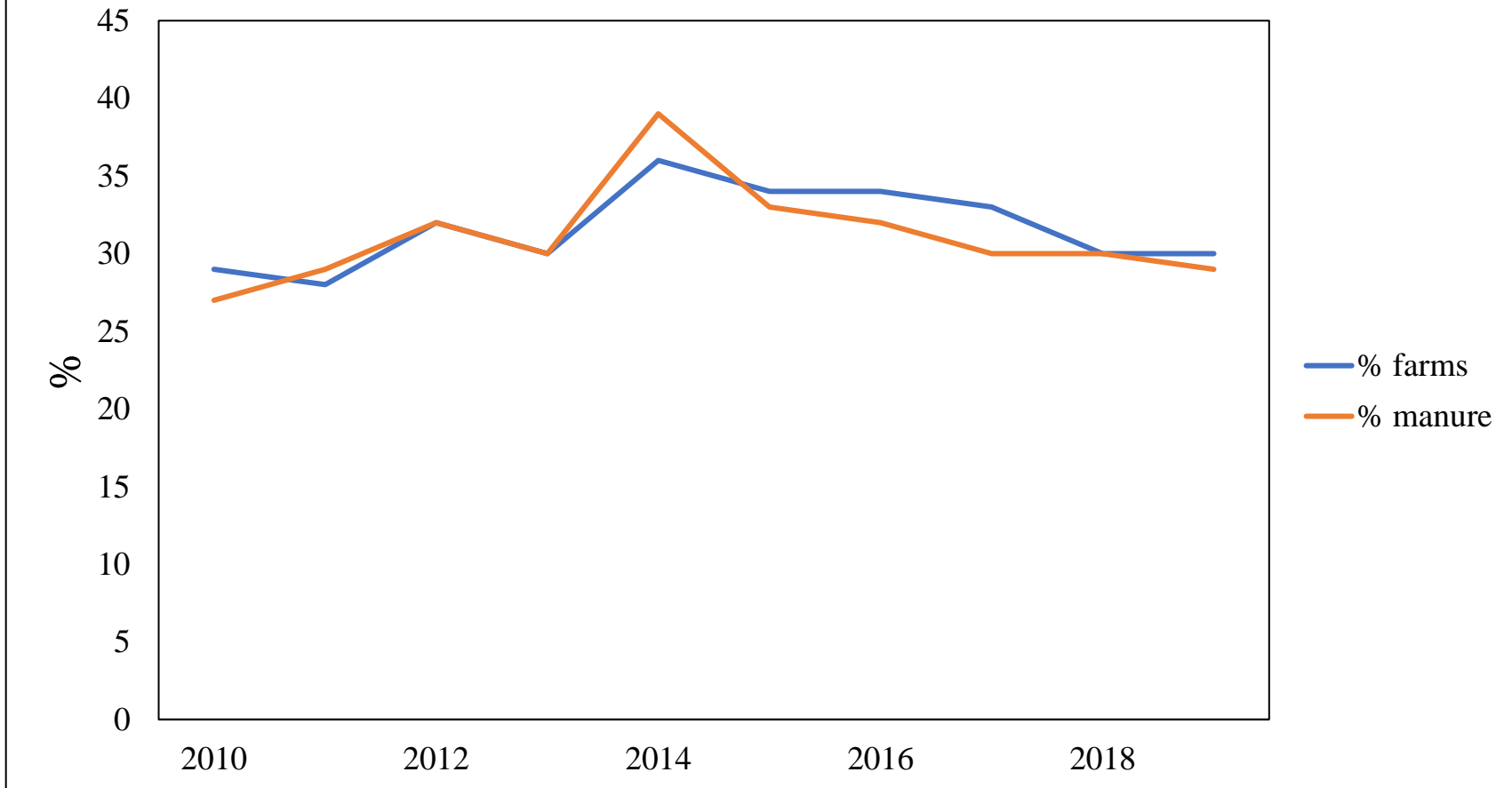
Amounts of nutrients in the material





Use of contractors to spread manure

(Source: BSFP, GB)



To ensure organic manure is applied accurately:

- Nutrient concentration in the manure must be estimated or measured
- The spreader must be in good condition
- Forward speed, rate of discharge and bout width must be matched to achieve intended rate of application
- Loss of nitrogen must be minimized

Nutrient concentrations

Nutrient Management Guide (RB209)

Updated February 2020

AHDB



British Beet
BBRO
Beet Growers' Organisation

FACTS

PRO

Section 2 Organic materials



Measurement or estimation of the nutrient concentrations in manures

(Source: Defra Farm Practices Survey 2020)

% of farms in England

Farm size:	Small	Medium	Large	All farms
Sampling and lab analysis	10	12	24	14
Sampling and on-farm testing	3	4	5	4
Based on published tables	29	44	45	36
No testing done	59	42	30	49

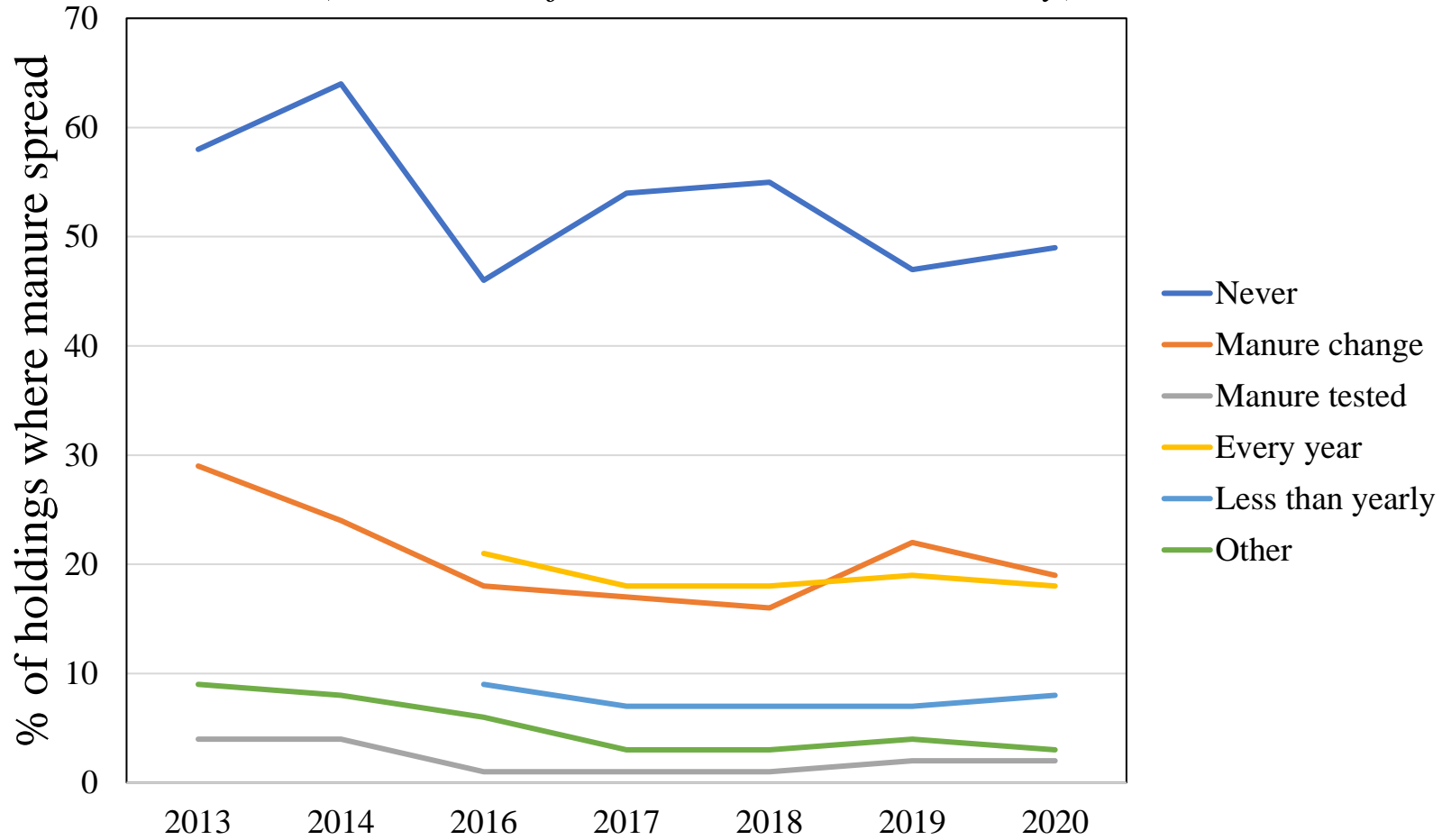
Rate of application

Factors affecting application rate

- Discharge rate
- Bout width
- Forward speed

Calibration of manure spreaders in England

(Source: Defra Farm Practices Survey)



Bout width

- Clear for trailing hose, trailing shoe, injection
- Broadcast spreaders – half full spreading width
- Tray testing?

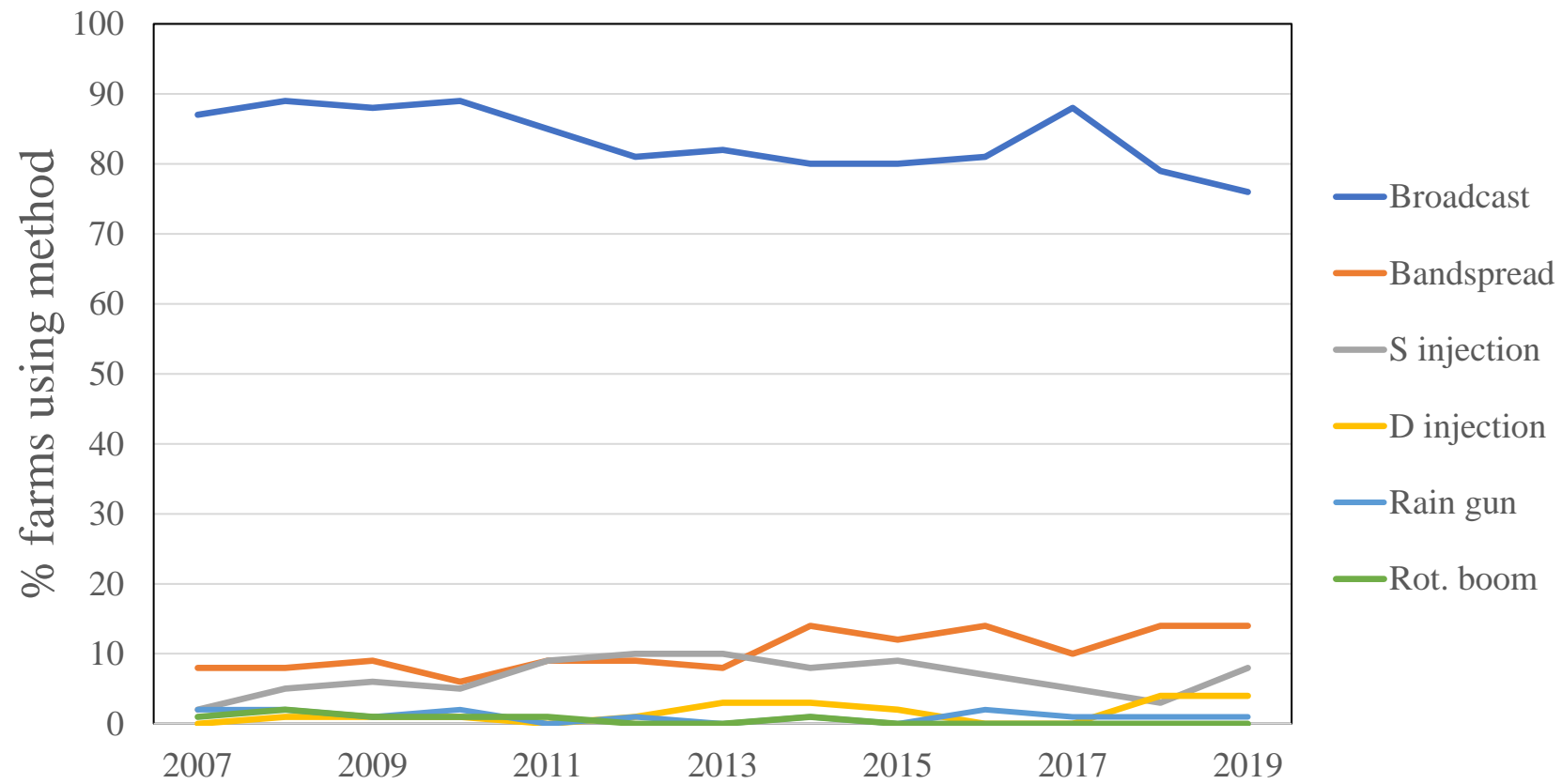
Ammonia loss

Reducing ammonia loss

- Rapid incorporation (6 hours for slurry, 24 hours for FYM) reduces loss by 40-70%
- Shallow injection of slurry reduces loss by around 70%
- Trailing hose or trailing shoe reduce loss by around 30%

Slurry application method in Great Britain

(Source: BSFP)



Incorporation rules/guidance

Document

Incorporation on arable land

NVZ guidance

within 24 hours (FYM if within 50m of water and land slopes, poultry, slurry, liquid sludge)

Farming Rules for Water

within 12 hours

COGAP for Reducing Ammonia Emissions

within 12 hours

Protecting Our Water, Soil and Air

within 6 hours (slurry), 24 hours (solid manures)

Improvements in technology

J. S. KEMP'S 20TH CENTURY MANURE SPREADER



THE FARMER'S MONEY MAKER







Developments in technology

- Weigh cells/flow meters
- Rate control systems
- GPS and maps: variable rate applications
- Section control on slurry spreaders
- NIR nutrient monitoring (N, P, K, NH₄)

Can we leave it all to technology?

Precision v accuracy

Precision



Accuracy



Subjective judgements

- Is there sufficient soil variation across a field to justify treating parts of the field separately?
- How many soil cores are needed for an adequately representative result in each area?
- Is the CV measured by tray-testing good enough?
- Is the fertiliser too lumpy/dusty?
- Are conditions going to stay good enough for manure spreading?

Summary

- Accurate nutrient application is as important as correct recommendations/guidance on nutrient use
- Spreader technology for fertilizers and manures is evolving rapidly
- Significant improvements have been made but there remains scope for improving accuracy of fertilizer and manure application
- *Human judgement still will be needed to ensure accuracy, not just precision*
- *Combination of technology and operator skills offers best way forward – with technology supporting the operator*