



The Potash Development Association

Nutrients in crop material



**PHOSPHATE AND POTASH
REMOVAL BY CROPS**



Nutrient offtakes

The information in the attached table is essential for farmers and advisors, and the P₂O₅ and K₂O values can also be found in the Fertilise Manual (RB209), 8th edition, 2010. The values shown are the agreed best estimates of the quantities of phosphate (P₂O₅), potash (K₂O) and guidance on the magnesium (MgO) removed in harvested crop products and in by-products such as straw. These are the offtakes of P₂O₅, K₂O and MgO per tonne of fresh material harvested; to maintain the nutrient fertility of the soil the total offtake must be replaced, through the use of fertilisers and manures (see overleaf for examples of the calculations).

Guidelines for calculation of PHOSPHATE, POTASH and MAGNESIUM removal by crops

		METRIC kg/t of fresh material			IMPERIAL units/t of fresh material		
		P ₂ O ₅	K ₂ O	MgO**	P ₂ O ₅	K ₂ O	MgO**
Cereals	grain only	7.8	5.6	2.0	15.6	11.2	4.0
	grain plus straw						
	winter wheat or barley	8.4*	10.4*	2.6*	16.8*	20.8*	5.2
	spring wheat or barley	8.6*	11.8*	2.7*	17.2*	23.6*	5.4
	winter/spring oats	8.8*	17.3*	n/d	17.6*	34.6*	n/d
Oilseed rape	seed only	14.0	11.0	2.0	27.0	22.0	4.0
	seed plus straw	15.1*	17.5*	n/d	30.2*	35.0*	n/d
Peas	dried	8.8	10.0	3.0	17.6	20.0	6.0
	vining	1.7	3.2	n/d	3.4	6.4	n/d
Field beans	seed only	11.0	12.0	2.3	22.0	24.0	4.6
Straw***	winter wheat or barley	1.2	9.5	1.2	2.4	19.0	2.4
	spring wheat or barley	1.5	12.5	1.3	3.0	25.0	2.6
	oilseed rape	2.2	13.0	1.3	4.4	26.0	2.6
	field peas	3.9	16.0	1.7	7.8	32.0	3.4
	field beans	2.5	16.0	1.8	5.0	32.0	3.6

Potatoes	tubers	1.0	5.8	0.3	2.0	11.6	0.6
Sugar beet	roots only	0.8	1.7	0.5	1.6	3.4	1.0
	roots plus tops	1.9	7.5	n/d	3.8	15.0	n/d
Grass	fresh grass @ 15-20% DM	1.4	4.8	n/d	2.8	9.6	n/d
	silage @ 25%DM	1.7	6.0	n/d	3.4	12.0	n/d
	silage @ 30% DM	2.1	7.2	n/d	4.2	14.4	n/d
	hay @ 86% DM	5.9	18.0	n/d	11.8	36.0	n/d
Kale		1.2	5.0	0.5	2.4	10.0	1.0
Forage maize	silage @ 30% DM	1.4	4.4	1.2	2.8	8.8	2.4
Swedes	roots only	0.7	2.4	0.2	1.4	4.8	0.4
Fodder beet	roots only	0.8	4.0	0.3	1.6	8.0	0.6
Broad beans		1.6	3.6	0.5	3.2	7.2	1.0
French beans		1.0	2.4	n/d	2.0	4.8	n/d
Beetroot		1.0	4.5	n/d	2.0	9.0	n/d
Cabbage		0.9	3.6	n/d	1.8	7.2	n/d
Carrots		0.7	3.0	n/d	1.4	6.0	n/d
Cauliflower		1.4	4.8	n/d	2.8	9.6	n/d
Onions	bulb	0.7	1.8	n/d	1.4	3.6	n/d
Sprouts	buttons	2.6	6.3	n/d	5.2	12.6	n/d
	stems	2.1	7.2	n/d	4.2	14.2	n/d
Bulbs		2.4	6.3	n/d	4.8	12.6	n/d

* Offtake value is per tonne of grain or seed removed but includes nutrients in straw when this is also removed and weight is unknown.

** The magnesium offtakes are based on very limited data and are for guidance only.

*** Use these values when straw weight is known. Potash content of straw can vary considerably – higher than average rainfall between crop maturity and straw baling will reduce straw potash content. Information on non-cereal straws is limited so values should be used only as a guide.

n/d = no data.

Standard recommendations

In contrast to nitrogen, the recommendations for phosphate and potash fertiliser are based principally on ensuring that the soil has sufficient reserves of these nutrients to be able to supply all that the crop needs during growth. This is measured by soil analysis, and the Index system has been devised to allow easy determination of whether a soil has adequate reserves. For agricultural cropping a soil phosphorus Index of 2 or 3 and a potassium Index of 2 are generally considered sufficient to supply the full needs of the crop during its growth. Thus at these nutrient Indices the usual fertiliser recommendation, except for potatoes, is to replace the nutrients removed at harvest. These are calculated by multiplication of the given offtake values by a standard crop yield, and have been called the 'maintenance' dressing.

Example calculations:

8 t/ha winter wheat crop, straw baled, removes:	67.2 kg P₂O₅/ha (8 t/ha x 8.4),
and	83.2 kg K₂O/ha (8 t/ha x 10.4),
and	20.8 kg MgO/ha (8 t/ha x 2.6).

8 t/ha winter wheat crop, straw chopped, removes:	62.4 kg P₂O₅/ha (8 t/ha x 7.8),
and	44.8 kg K₂O/ha (8 t/ha x 5.6),
and	16.0 kg MgO/ha (8 t/ha x 2.0).

10 tonnes of spring barley straw contains:	15.0 kg P₂O₅ (10 tonnes x 1.5),
and	125 kg K₂O (10 tonnes x 12.5),
and	13.0 kg MgO (10 tonnes x 1.3).

Where crop yield is expected to differ from the standard values in the Fertiliser Manual, the P₂O₅ and K₂O recommendations can be adjusted using these offtake values. For example, the standard recommendation of 90 kg/ha P₂O₅ for wheat at P Index 1 for an 8 t/ha crop should be increased by $2 \times 7.8 = 15.6$ kg/ha P₂O₅ to 116 kg/ha P₂O₅ if a yield of 10 t/ha is expected, and K₂O similarly.

Nutrient offtake and nutrient uptake

The values in the table are the estimated nutrient **offtakes**. Particularly for potash, these quantities are very considerably lower than the nutrient **uptake** by the growing crop. The soil nutrient reserves must be sufficient for the crop to be able to obtain all the K₂O it requires to reach its full yield potential and to ensure efficient use of N and other nutrients. So although for example an 8 t/ha wheat crop removes only about 45 kg K₂O in the grain, the growing crop can contain 300 kg/ha K₂O; this has to be taken up from the soil which therefore should be not lower than K Index 2. Much of the K₂O in the crop is returned to the soil as the crop matures, but a considerable amount is retained in the straw. If the straw is ploughed in this K₂O is also returned to the soil, but if it is baled then the 12.5 kg potash it contains per tonne is removed, along with that in the grain.

FOR MORE INFORMATION ON POTASH CONTACT:-

Potash Development Association,

PO Box 697, York YO32 5WP.

Tel & fax 01904 492009

email: info@pda.org.uk

www.pda.org.uk



The Potash Development Association is an independent technical organisation formed to support the efficient use of potash fertiliser in the UK

