

Reinvasion by kikuyu grass after regrassing on a dairy farm

B.A. PATON¹ and G.J. PIGGOT²

¹*S.H. 1, Ruakaka, R.D. 1, Whangarei*

²*Pasture Assessment Ltd, P.O. Box 1590, Whangarei
epi@igrin.co.nz*

Abstract

On a farm at Ruakaka, south of Whangarei, an intensive regrassing programme was begun in 2000 to remove kikuyu grass using glyphosate herbicide, replacing it with ryegrass. The programme reached a peak in 2003 and 2004 when up to 25% of the paddocks were in various stages of regrassing. The standard process was to spray kikuyu pastures with glyphosate in autumn, drill annual ryegrass, crop with turnips in summer and sow a permanent pasture mix in autumn - a three-spray programme. Other spray and regrass programmes, and alternative pasture mixes were also trialled. In the hill paddocks on northern aspects, kikuyu was detected at low levels in the sown new grass in the first and second years, rising to 60-70% of the observations in the third year and 100% by the fourth. On the southern aspects the ingress was much slower. On the flat paddocks, kikuyu content of the pasture was small until the fifth autumn. From a practical viewpoint, removing kikuyu from flat paddocks appears worthwhile, but this may not be so on hill or mixed hill/flats.

Keywords: kikuyu reinvasion, regrassing, ryegrass, glyphosate herbicide, kikuyu seed

Introduction

The autumn control of kikuyu grass on a split-calving or winter-milk dairy farm requires topping or mulching which is expensive and time consuming. Mobs of dry cows are not available for kikuyu control by hard grazing. The best option appears to be eradication using glyphosate herbicide. An intensive regrassing programme was begun in 2000 on a Ruakaka split-calving dairy farm to eradicate, or attempt to reduce the influence of kikuyu grass.

Materials and Methods

The farm is located beside State Highway 1 at Mata/Ruakaka, south of Whangarei, and is a mix of flat, rolling, and hilly land. About one-third of the cows calve in autumn (April/May) and the remainder in late winter (July/August). The stocking rate by October is about 3 cows per pasture hectare and there is supplementary feeding of maize silage, grass silage and palm kernel as required. Current annual milk production is about 950 kg MS/ha.

The standard regrassing process (the three-spray system) involved mulching of the target kikuyu grass

paddocks in summer to provide fresh leaf without coverings of trash or dung for March spraying with glyphosate at 1-2 kg a.i./ha. Annual ryegrass was then drilled and grazed occasionally during winter and early spring before respraying with glyphosate, minimal cultivation and sowing of a turnip crop in October. The turnips were grazed once in January or February and resprayed before direct-drilling a mixture of perennial ryegrass and white clover in March or April. Variations on this three-spray process have involved sowing of tall fescue or chicory as the permanent pasture, missing one or two of the sprays, or drilling the permanent pasture after spraying the kikuyu once in the first autumn. Paddocks having all possible aspects and slopes have been regrassed. The programme began in 2000 and reached a peak from 2003 to 2005, with over 25% of paddocks involved in the process.

From 2004 the reinvasion of kikuyu grass was monitored. The monitoring involved walking across each paddock, making an observation every five steps. This gave 30-50 observation points in each paddock. The presence of kikuyu grass within 50 cm of the toe point was recorded. The presence of kikuyu at the toe point was also recorded but these data are not reported here and are available on request. Reinvasion was monitored once in late summer or early autumn from 2004 to 2009 along the same walking transect as before, and about one-third of the paddocks on the farm (30) were monitored. Some paddocks were also split and different aspects were monitored separately. Once a paddock was recorded as 90% kikuyu or above it was not monitored in subsequent years.

Investigations were made into the mechanism of kikuyu reinvasion. In the autumn (May) of 2004 all the paddocks sown with permanent pastures after the three-spray programme were searched for kikuyu plants. In addition, a string line was placed across one hill paddock sown with perennial ryegrass after the three-spray programme. On the string line the exact position of any germinating seedlings was marked. The string line was resited in the following autumn to check the survival of those seedlings and the establishment of new ones.

In May 2004, about 500g of soil was cored using a 20 mm corer to 5 cm depth from six paddocks monitored in the "Paton project" (KAG 2007). These paddocks all had a different regrassing history in autumn 2004,

ranging from none through 1, 2, or 3 sprays, being on flats or hills, and sown with ryegrass or tall fescue. The soil was immediately placed in shallow pots to allow any kikuyu seed to germinate under regular watering in a polyhouse, enabling the identification of establishing plants.

In May 2005, 5 kg of surface soil (sampled to 5 cm by spade) was taken from a three-spray paddock which had mixed contour so that soil from flat or hill land could be compared. All the soil was placed in flat trays in a polyhouse and treated similarly to the 2004 soil sampling to allow identification of establishing kikuyu plants.

In late March 2006, samples of 5 kg of surface soil were taken from three hill paddocks; not sprayed, sprayed with glyphosate after normal preparation for drilling annual ryegrass, and from a three-spray paddock about to be sown with permanent pasture. Similar paddocks were sampled at another farm at Kerikeri.

The data collected on kikuyu presence in each paddock were not amenable to statistical analysis because too few paddocks were sampled for each aspect, orientation, species sown or spray programme. Also, a high proportion of paddocks surveyed either

had low or high percent presence of kikuyu. Similarly, with the studies of the mechanism of reinvasion, there were few kikuyu plants counted.

Results

The paddocks surveyed were defined by aspect, orientation, the year that permanent pasture was autumn sown, and the primary species sown (Table 1). On the flat land the reinvasion by kikuyu was slower than on the southern aspect paddocks, while on the northern aspects, reinvasion occurred mostly within 3 years, but at a slower rate on ryegrass paddocks. The chicory and tall fescue alternatives showed similar reinvasion patterns as to where perennial ryegrass was sown.

The studies of the mechanism of reinvasion after the three-spray programme, suggested that seed rather than stolons was the kikuyu source even though the initial seedling establishment occurred at a low level of less than 1 plant/m². The autumn 2004 survey showed none of the paddocks had more than one kikuyu plant/m². On the string line, ten seedlings were found in 2004 but only eight in 2005. In the 2004 soil sampling, although six paddocks were sampled and each with different orientation, slope, or spray programme, only two seedlings were germinated from the entire

Table 1 Kikuyu presence as percentage encountered on a single transect across each paddock in late summer/autumn of each year (2004 to 2009). The paddocks had been sown to permanent pasture after the three-spray programme unless otherwise labelled. Data are means across paddocks within each year.

Sown species (aspect)	Year Sown	No. of Pdks	2004	2005	2006	2007	2008	2009	
Ryegrass (flat)	2001	1	8	13	52	62	79	70	
	2002	2	7	17	44	74	86	98	
	2003	3	3	14	27	37	58	61	
	2004	3	-	0	1	13	25	18	
	2005	4	-	-	0	10	13	21	
	2005 ¹	1	-	-	51	62	65	95	
2006	3	-	-	-	9	35	50		
Ryegrass (hills)	North facing	2004	4	-	7	86	87	100	
		2004 ²	1	-	21	50	88	100	
	South facing	2004	1	-	11	28	45	47	53
Tall fescue (flat)	2003	1	2	12	42	47	65	N/A	
Tall fescue (hill)	2004	3	-	25	89	86	100		
	North facing	2005	1	-	-	47	48	92	
	South facing	2005	1	-	-	0	7	N/A	29
Chicory (hill)	2004	1	-	27	45	62	100		
	2005	1	-	-	23	43	78	86	

¹ = one spray; ² = two sprays

sampling. From the larger quantity of soil sampled in 2005, no kikuyu seedlings were germinated from the flat land samples and only three germinated from the hill samples. In 2006, six or seven seedlings germinated from the unsprayed or one-spray paddock, but only one seedling germinated from the three-spray paddock. At Kerikeri, two seedlings germinated from the unsprayed or one-spray and none from the three-spray paddock. The expectation that the three-spray programme reduces the seed load is supported by this work, but the effect is small and cannot be used to eliminate the seed source of reinvasion.

Discussion

The first step in the three-spray programme has proved reliable provided the paddock was prepared correctly with short regrowth and no covering of dung or trash, allowing the autumn spray of glyphosate to kill all the resident kikuyu grass. Provided the trash was minimal, the ryegrass established well and with a further glyphosate spray in spring, allied with minimal cultivation, the turnip crop was also successfully established. The ground was almost bare in the next autumn and the final spray tidied up any residual weeds before sowing the permanent pasture. However, the process is detailed and expensive and the dry matter yields of the new pasture do not always exceed the yield of the original pasture (KAG 2007, additional data available on request). The value in the process hinges on the ability to remove kikuyu. Any short-cuts to the three-spray process resulted in a worse kikuyu reinvasion. The reinvasion of kikuyu grass on flat paddocks was slow and the expectation is that they will remain relatively kikuyu-free for 5 years. On the south facing aspects the data lacks replication but suggests that kikuyu reinvasion will be similar to the flat land. On the north facing slopes the kikuyu reinvasion was

rapid, most paddocks remaining relatively kikuyu-free for only 2 years.

In summary, the process of regrassing and kikuyu eradication has been worthwhile on flats and south facing paddocks. On north facing slopes the process has not been worthwhile if the objective is to control kikuyu grass. A combination of factors makes eradication of kikuyu grass on northern aspects difficult. North facing paddocks tend to be drier and grow less pasture because of harder grazing. Short trimming of kikuyu grass stimulates flowering and, depending on the availability of pollen and the presence of male-fertile plants to provide this pollen, seed will be set and eaten by cows, spreading it around the farm in dung. A solution to the reinvasion of northern slopes has become an important part of removing kikuyu from the remainder of the farm.

The studies reported here on the process of kikuyu reinvasion and its timing point to solutions to the eradication problem. It appears that kikuyu re-establishes from seed at a very low density and reinvades by the spreading of the stolons. This theory supports the practice of eliminating kikuyu using spot spraying of small and dispersed plants. The theory would also support a regular respray-and-resow concept, but no such technique has been proven and awaits further research.

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REFERENCE

KAG, 2007. Cost-effective processes for kikuyu elimination in pastures. Pamphlet 7. Published by the Kikuyu Action Group.