

This Technical Data Sheet describes the *typical average properties* of the specified soil.

It is essentially a summary of information obtained from one or more profiles of this soil that were examined and described during the Topoclimate survey or previous surveys. It has been prepared in good faith by trained staff within time and budgetary limits. However, no responsibility or liability can be taken for the accuracy of the information and interpretations. Advise should be sought from soil and landuse experts before making landuse decisions on individual farms and paddocks. The characteristics of the soil at a specific location may differ in some details from those described here.

No warranties are expressed or implied unless stated.

Soil name: Pukemutu

Overview

Pukemutu soils occupy about 47,600 hectares on high terraces south of the Taringatura and Hokonui hills, extending across the Southland Plain. They also occur intermittently north of the Hokonui Hills on dissected terraces and fans from Mandeville to Mossburn. They are formed in deep loess derived from tuffaceous greywacke. They have heavy silt loam, grading with depth to silty clay, textures and are poorly drained, with a dense fragipan between 60 and 90cm depth which restricts water drainage. They respond well to mole and tile drainage and are used for intensive sheep, dairy and deer production, with some cropping. Regular summer rainfall occurs, though inland soils may be seasonally dry.

Soil classification

NZ Soil Classification (NZSC):

Argillic-fragic Perch-gley Pallic; stoneless; silty over clayey

Previous NZ Genetic Classification:

Yellow-grey earth

Classification explanation

The NZSC of the Pukemutu soil is consistent with the previous classification. Pukemutu soils are poorly drained, due to perching of water on a dense fragipan. The subsoil above the fragipan also typically has high density, which limits root growth. Pukemutu soils have silty textures in the upper horizons, but the lower subsoil is typically more clayey due to the accumulation of clay in or above the fragipan. The soils typically have P-retention of <30% throughout the profile, and are stone free.

Soil phases and variants

Identified units in the Pukemutu soils are:

- Pukemutu undulating deep (PgU1): occurs on slopes of 0–7°
- Pukemutu undulating deep, floodplain variant (PgU1vf): occurs on stable floodplains on slopes of 0–7°
- Pukemutu undulating moderately deep (PgU2): has gravel between 45 and 90cm depth and occurs on slopes of 0–7°
- Pukemutu undulating moderately deep, floodplain variant (PgU2vf): occurs on stable floodplains with gravel between 45 and 90cm depth and has slopes of 0–7°
- Pukemutu rolling deep (PgR1): occurs on slopes of 7–15°
- Pukemutu hilly deep (Pgh1): occurs on slopes of >25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Pukemutu undulating deep (PgU1). Values for other phases and variants can be taken as being similar. Where they differ significantly they are recorded with a separate versatility rating, e.g., Pukemutu hilly deep (Pgh1).

Associated soils

Some soils that commonly occur in association with Pukemutu soils are:

- Braxton: moderately deep to deep Gley soil on terraces with heavy silt loam to clayey textures; has no perch-gley properties or fragipan within 90cm depth
- Makarewa: Gley soil with clayey textures on the floodplain
- Woodlands: imperfectly drained Brown soil without a fragipan
- Tisbury: Gley soil on terraces of the Southland Plain; has silty textures throughout and is strongly leached, with moderate to high P-retention; has no perch-gley properties or fragipan within 90cm depth.

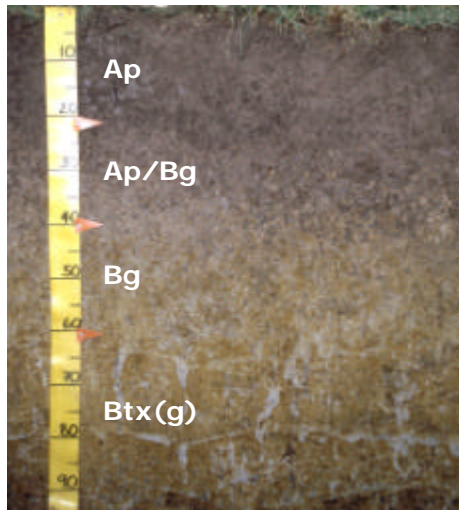
Similar soils

Some soils that have similar properties to Pukemutu soils are:

- Aparima: imperfectly drained equivalent of the Pukemutu soil
- Mossburn: similar profile form to Pukemutu, but has siltier textures throughout the profile; formed in mixed loess and colluvium on fans flanking the Taringatura Hills; commonly has stones scattered through the profile
- Waikoikoi: has silty textures throughout the profile; fragipan has prismatic structure and occurs at a shallower depth (45–60cm)
- Hokonui: has clayey textures, and formed in mixed loess and alluvium on fans from the Hokonui Hills; has perch-gley properties but not fragipan

Typical profile features

The following is a 'generic' or composite profile description representing the most common combination of characteristics for this soil type. The actual profiles for which descriptions and data are available are listed at the end of this Technical Data Sheet.

Pukemutu profile	Horizon	Depth (cm)	Description
	Ap	0–22	Greyish yellow-brown silt loam; weak soil strength; moderately developed medium polyhedral structure; abundant roots
	Ap/Bg	22–40	Greyish yellow silt loam; common orange mottles; abundant worm casts; weak soil strength; moderately developed medium blocky structure; abundant roots
	Bg	40–61	Light grey silt loam; common reddish brown mottles; few worm casts; slightly firm soil strength; moderately developed medium to coarse blocky structure; many roots
	Btx(g)	61–90	Bright brown silty clay; common light grey veins and mottles; firm soil strength; moderately developed extremely coarse blocky breaking to coarse to medium blocky structure; few roots in veins

Key profile features

Pukemutu soils have a 15–25cm deep topsoil that has moderately developed structure. Subsoil structure is moderate to weak in the upper subsoil, abruptly changing in the lower subsoil to the moderately developed extremely coarse prismatic structure of the fragipan. The fragipan is distinctive from the fragipans of other soils by the bright brown colour, and having a densely packed blocky or platy sub-structure. Greyish colours are dominant in the upper subsoil, indicating the poor drainage caused by water perching on the fragipan.

Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–22	Moderate – High	<i>Moderate</i>	Silt loam	Gravel free
Ap/Bg	22–40	Moderate – High	<i>Moderate</i>	Silt loam	Gravel free
Bg	40–61	Moderate – High	<i>Slow</i>	Silt loam	Gravel free
Btx(g)	61–90	High	<i>Slow</i>	Silty clay	Gravel free

Profile drainage: Poorly drained
Plant readily available water: *Moderately high to high*
Potential rooting depth: Moderately deep
Rooting restriction: Fragipan

Key physical properties

Pukemutu soils have a moderately deep potential rooting depth that is severely restricted by the fragipan at 60–90 cm depth. The depth of the fragipan means the Pukemutu soils typically have moderately high to high plant available water. The soils are poorly drained, with very slow permeability in the subsoil and limited aeration during sustained wet periods. Textures are typically heavy silt loams, increasing to silty clay in the lower subsoil. Topsoil clay content is typically 25–30%, and stone free. The moderately deep variants have gravel between 45 and 90cm depth.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–22	Moderate	Low	Low	Moderate	Moderate	Very low	Very low	Low
Ap/Bg	22–40	Moderate	Low	Low	Low	Low	Very low	Very low	Low
Bg	40–61	Moderate	Low	Low	High	Low	Moderate	Low	Low
Btx(g)	61–90	Moderate	Low	Low	High	Low	High	Very low	Low

Key chemical properties

Organic matter values range from 4 to 6%; P-retention values under 30%; pH values above 5.5 but tend to decline down the profile. Cation exchange values are low, with base saturation increasing in the subsoil, which also has higher magnesium values than the topsoil. Values for available calcium, potassium and sodium are low. Phosphorus reserves are low and sulphur levels increase in the subsoil. Good responses to lime and phosphate occur. Micro-nutrient levels are generally adequate, although boron responses in brassicas and molybdenum responses in legumes can occur.

Vulnerability to environmental degradation

Note: the vulnerability ratings given in the table below are generalised and should not be taken as absolutes for this soil type in all situations. The actual risk depends on the environmental and management conditions prevailing at a particular place and time. Specialist advice should be sought before making management decisions that may have environmental impacts. Where vulnerability ratings of Moderate to Very severe are indicated, advice may be sought from Environment Southland or a farm management consultant.

Vulnerability factor	Rating	Vulnerability compared to other Southland soils
Structural compaction	Severe	These soils have a severe vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles. This rating reflects the poor drainage, low clay and P-retention in the topsoil that results in low structural stability.
Nutrient leaching	Slight	These soils have a slight vulnerability of leaching to ground water. The vulnerability is strongly influenced by the moderately high water-holding capacity and the slow permeability of the subsoil. Lateral water flow in installed mole and tile drains would increase losses.
Topsoil erodibility by water	Moderate	Due to the low clay content, the topsoil erodibility of these soils is moderate. Erodibility is highly dependent on management, especially when there is no vegetation cover.
Organic matter loss	Slight	Vulnerability to long-term decline in soil organic matter levels is partly dependent on soil properties, and highly dependent on management practices (e.g., crop residue management and cultivation practices)
Waterlogging	Severe	These soils have severe vulnerability to waterlogging during wet periods. This rating reflects the poor drainage and slow permeability.

General landuse versatility ratings for Pukemutu soils

Note: The versatility ratings in the table below are indicative of the major limitations for semi-intensive to intensive landuse. These ratings differ from those used in the past in that sustainability factors are incorporated in the classification.

Refer to the Topoclimate district soil map or property soil map to determine which of the soil symbols listed below are applicable, then check the versatility ratings for that symbol in the appropriate table.

PgU1 (Pukemutu undulating deep)

PgU1vf (Pukemutu undulating deep flood plain variant)

PgU2 (Pukemutu undulating moderately deep)

PgU2vf (Pukemutu undulating moderately deep flood plain variant)

Versatility evaluation for soil PgU1, PgU1vf, PgU2, PgU2vf

Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rainfall.
Arable	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rainfall.
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rainfall.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to sustained waterlogging.

PgR1 (Pukemutu rolling deep)

Versatility evaluation for soil PgR1

Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Inadequate aeration during wet periods; risk of short-term waterlogging after heavy rainfall.
Arable	Limited	Rolling slopes; risk of short-term waterlogging after heavy rainfall.
Intensive pasture	Limited	Risk of short-term waterlogging after heavy rainfall.
Forestry	Limited	Inadequate aeration during wet periods; vulnerability to sustained waterlogging.

PgH1 (Pukemutu hilly deep)

Versatility evaluation for soil PgH1

Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes; risk of short-term waterlogging after heavy rain.
Forestry	Limited	Inadequate aeration during wet periods.

Management practices that may improve soil versatility

- Careful management after heavy rain and wet periods will reduce the impact of short-term waterlogging. Intensive stocking, cultivation and heavy vehicular traffic should be minimised during these periods.
- Installation and maintenance of sub-surface mole and tile drains will reduce the risk of short-term waterlogging.
- If compaction occurs, aeration at the correct depth and moisture condition can be of benefit.

Soil profiles available for Pukemutu soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
PgU1	YT5	9	✓	✓	✓	✓
PgU1	YT2	9	✓	✓	✓	✓
PgU1	YT9	9	✓	✓	✓	✓
PgU1	YT14	9	✓	✓	✓	✓
PgU1	CT1	6	✓	✓	✓	✓
PgU1	CT2	6	✓	✓	✓	✓
PgU1	CT8	6	✓	✓	✓	✓
PgU1	CT21	6	✓	✓	✓	✓
PgU1	1T3	8	✓	✓	✓	✓
PGu1	IT4	8	✓	✓	✓	✓
PgU1	XT13	13	✓	✓	✓	✓
PgU1	XT14	13	✓	✓	✓	✓
PgR1	GMT1	27	✓	✓	✓	✓
PgU1	168/75/39	9	✓	✓		
PgU1	M2407	1	✓	✓	✓	
PgU1	SB5948	9	✓	✓		
PgU1	SB7691	6	✓	✓		
PgU1	IT14	8	✓	✓	✓	✓

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Crops for Southland
PO Box 1306, Invercargill. New Zealand



www.cropssouthland.co.nz