

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: Benio

Overview

Benio soils occupy about 5000 ha on the higher parts of the downlands north of Gore and high terraces of the Waimea plain. These soils are formed in a thin layer of loess overlying old and strongly weathered gravelly alluvium. Benio soils are typically moderately well drained shallow soils with gravelly subsoils. They are suited to pastoral farming, with forestry established on some areas.

Soil classification

NZ Soil Classification (NZSC):

Typic Yellow Ultic; rounded-stony, quartzic; silty

Previous NZ Genetic Classification:

Strongly leached yellow-brown earth

Classification explanation

The NZSC of Benio soils is consistent with previous classifications. They are strongly weathered and leached soils, with clayey textures and pH of less than 5.5 in the subsoils. Benio soils have quartz gravel within 45cm depth, and silty textured topsoils.

Soil phases and variants

Identified units in the Benio soils are:

- Benio undulating moderately deep (BnU2): has gravel between 45 and 90cm; occurs on slopes of 0–7°
- Benio undulating shallow (BnU3): has gravel above 45 cm; occurs on slopes of 0–7°
- Benio rolling shallow (BnR3): has gravel above 45cm; occurs on slopes of 8–15°
- Benio hilly shallow (BnH3): has gravel above 45cm; occurs on slopes of 16–25°

The soil properties described in this Technical Data Sheet are based on the most common phase, Benio undulating shallow (BnU3). 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., Benio hilly shallow (BnH3).

Associated soils

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

- Waikoikoi: no gravel within 90cm; poorly drained with a fragipan
- Chatton: well drained, with no gravelly layers above 45cm depth

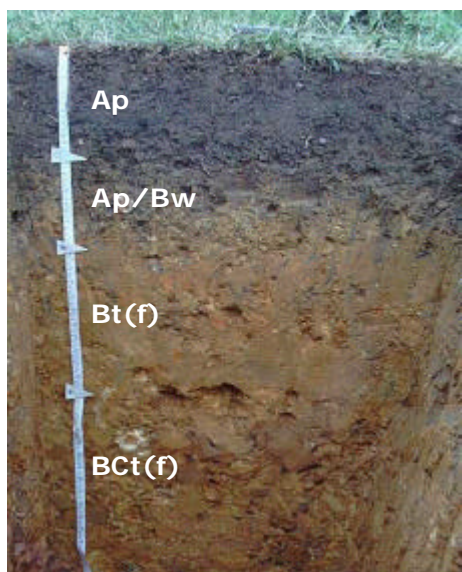
Similar soils

Some soils that have similar properties to Benio soils are:

- Kaweku: Occur on intermediate terraces; only moderately weathered gravel
- Wairaki: Occur on high terraces and fans from the Takitimu mountains
- Oteramika: Occur on shoulder and side slopes in central and southern Southland, where loess has been eroded away

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.

Benio profile	Horizon	Depth (cm)	Description
	Ap	0–17	Greyish yellow brown slightly gravelly silt loam; weak soil strength; strongly developed fine polyhedral structure; gravel slightly weathered rounded quartz; abundant roots
	Ap/Bw	17–32	Yellowish brown moderately gravelly silt loam; many wormcasts; weak soil strength; strongly developed moderate polyhedral structure; gravel slightly weathered rounded quartz; abundant roots
	Bt(f)	32–59	Yellowish brown very gravelly silty clay; many orange mottles; slightly firm soil strength; weakly developed coarse blocky structure; gravel strongly weathered greywacke and slightly weathered quartz; few roots
	Bt(f)	32–59	Yellowish brown very gravelly silty clay; many orange mottles; slightly firm soil strength; weakly developed coarse blocky structure; gravel strongly weathered greywacke and slightly weathered quartz; few roots
	BCt(f)	59–105	Bright yellowish brown extremely gravelly silty clay; many orange mottles; slightly firm soil strength; massive; gravel strongly weathered greywacke and slightly weathered quartz; no roots

Key profile features

Benio soils have a topsoil less than 20cm deep with moderately developed structure. Subsoil structural development is weak, with yellowish brown colours. The bright yellowish brown colours reflect the strong weathering in these soils. Clay has accumulated in the subsoil, resulting in clayey textures. Gravel occurs throughout the profile, and are a mixture of slightly weathered quartz and strongly weathered greywacke.

Typical physical properties

Note: values in *Italics* are estimates

Horizon	Depth (cm)	Bulk density	Permeability	Texture	Gravel content
Ap	0–17	Moderate – High	<i>Moderate</i>	Silt loam	Slightly gravelly
Ap/Bw	17–32	Moderate – High	<i>Moderate</i>	Silty clay	Moderately gravelly
Bt(f)	32–59	Moderate – High	<i>Slow</i>	Silty clay	Very gravelly
BCt(f)	59–90	Moderate – High	<i>Slow</i>	Silty clay	Extremely gravelly

Profile drainage: Moderately well
Plant readily available water: *Moderate*
Potential rooting depth: Moderately deep
Rooting restriction: Extremely gravelly subsoil

Key physical properties

Benio soils have moderately deep rooting depth and moderate plant available water, and are limited by the subsoil gravel. The soils are moderately well drained, but are slowly permeable in the subsoil. Textures are heavy silt loams in the topsoil, and silty clay in the subsoil. Topsoil clay content is 30–40%, and slightly to moderately gravelly. Subsoils are typically very to extremely gravelly.

Typical chemical properties

Horizon	Depth (cm)	pH	P retention	CEC	BS	Ca	Mg	K	Na
Ap	0–17	Moderat	Low	Moderat	High	High	Low	Very low	Low
Ap/Bw	17–32	Moderat	Moderate	Moderat	Moderat	Moderat	Low	Very low	Low
Bt(f)	32–59	Low	Moderate	Moderat	Very low	Very low	Low	Very low	Very low
BCt(f)	59–90	Low	Moderate	Moderat	Very low	Very low	Low	Very low	Low

Key chemical properties

Topsoil organic matter levels are 5–6%, profile P retention values 25–40%, pH values are moderate but low (<5.2) in the subsoil. Cation exchange values are medium with base saturation decreasing to low in the subsoil. Reserves of phosphorus and potassium are low with moderate levels of sulphate sulphur in the subsoil. Soils respond well to lime and phosphate with developing potassium requirements. 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	moderate	These soils have a moderate vulnerability to structural degradation by long-term cultivation, or compaction by heavy stocking and vehicles.
Nutrient leaching	severe	These soils have a severe vulnerability to leaching to groundwater. This rating reflects the good drainage and low total available water.
Topsoil erodibility by water	slight	Due to the clay content, the topsoil erodibility of these soils is slight. Erodibility is highly dependent on management, particularly 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	slight	These soils have a slight vulnerability to waterlogging during wet periods. This rating reflects the good drainage, but slow subsoil permeability.

General landuse versatility ratings for Benio 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.

BnU2 (Benio undulating moderately deep)

BnU3 (Benio undulating shallow)

Versatility evaluation for soil BnU2, BnU3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Ease of subsoil root growth
Arable	Moderate	Risk of short-term waterlogging and vulnerability of leaching to groundwater
Intensive pasture	Moderate	Ease of subsoil root growth and vulnerability to leaching to groundwater
Forestry	Moderate	Limited rooting depth and ease of subsoil root growth

BnR3 (Benio rolling shallow)

Versatility evaluation for soil BnR3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Limited	Ease of subsoil root growth
Arable	Limited	Rolling slopes
Intensive pasture	Moderate	Ease of subsoil root growth and vulnerability of leaching to groundwater
Forestry	Moderate	Limited rooting depth and ease of subsoil root growth

BnH3 (Benio hilly shallow)

Versatility evaluation for soil BnH3		
Landuse	Versatility rating	Main limitation
Non-arable horticulture	Unsuitable	Hilly slopes
Arable	Unsuitable	Hilly slopes
Intensive pasture	Limited	Hilly slopes
Forestry	Moderate	Rooting depth and hilly slopes

Management practices that may improve soil versatility

- Tile drains to assist drainage. Stony subsoils may prevent mole installation.
- Care with intensive grazing to minimise pugging when soils are excessively wet.
- Management of nutrient applications that minimise leaching losses

Soil profiles available for Benio soils

Soil symbol	Profile ID	Topoclimate map sheet	Profile description available	Physical data available	Chemical data available	Profile photo available
BnU3	RT9	11	✓	✓	✓	✓
BnU3	GG/GW 38	35	✓	✓		

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