Comparison of Major Minerals Uptake between Conventional and Non-Tillage/Non-Fertilizer Vegetables in Japan

不耕起/無施肥栽培における野菜のミネラル吸収量の解析

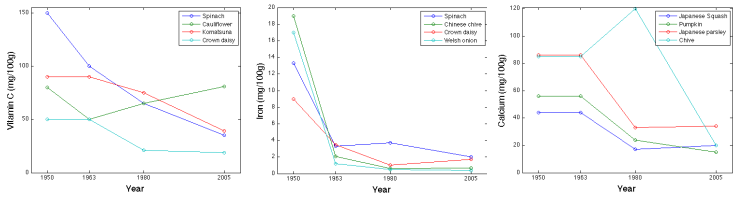
P1-36

Masatoshi Funabashi / 舩橋 真俊
masa_funabashi@csl.sony.co.jp
Sony Computer Science Laboratories, Inc.

Key Words: non-tillage, non-fertilizer, minerals uptake

Background and objectives

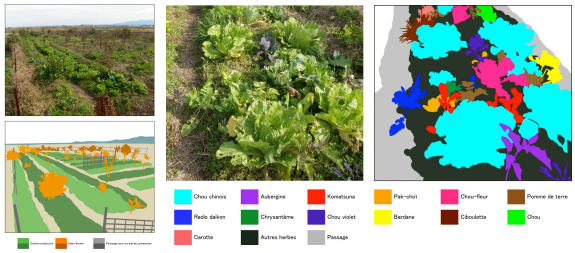
According to the nutrition standard database published from ministry of agriculture, trophic factors of vegetables such as vitamin, iron, minerals in japan are known to decrease after 1950 with the rise of conventional agriculture. This change is correlated with the development of chemical fertilizer and practice of intensive monoculture.
This study tries to compare between conventional and cultivation method with non-tillage/non-fertilizer and investigate the effect on minerals concentration in vegetables.



Reference: Standard tables of food composition in Japan/日本食品標準成分表(文部科学省)

Methods

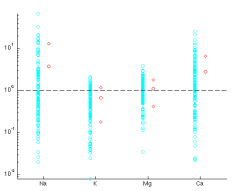
We have established a new culture system, namely Synecoculture, based on a mixture of plural vegetables in open culture without tillage nor fertilizer to produce a closely natural state metabolism of vegetable and conformation of soil. We analyzed 140 samples from 37 vegetable species and empirically measured 4 major ions: Na, K, Ca, M both of vegetables and cultivation field.



Results

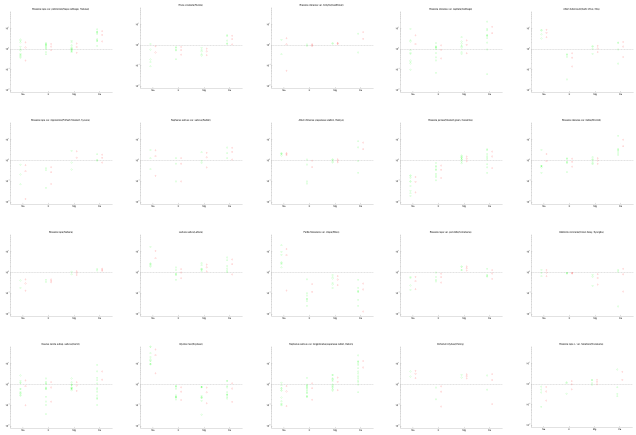
The results of soil ion analysis showed the field dose is qualitatively in the same level as surrounding natural state, meaning a part of minerals are not sufficient/unbalanced compared to the standard of conventional method. Nevertheless, concentration of Na, Ca, Mg in vegetables showed higher average than Japanese conventional standard.

Minerals in Vegetables



Up:
○: Total 140 sample plot of Synecoculture products/Japanese standards 2010
協生農法野菜/日本食品標準成分表2010
○: Mean value
◇: Standard Deviation

Right:
○: Vegetable-wise plot of Synecoculture products/Japanese standards 2010
協生農法野菜/日本食品標準成分表2010
○: Mean value
◇: Standard Deviation



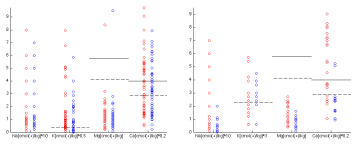
Vegetable Name	Sample Number
Raphanus sativus var. longipinnatus(Japanese radish, Daikon)	14
Daucus carota subsp. sativus(Carrot)	12
Brassica rapa var. peksinensis(Napa cabbage, Hakusai)	11
Glycine max(Soybean)	10
Brassica oleracea var. capitata(Cabbage)	10
Brassica juncea(Mustard green, Karashina)	9
Perilla frutescens var. crispa(Shiso)	7
Lactuca sativa(Lettuce)	6
Brassica oleracea var. italica(Broccoli)	6
Eruca vesicaria(Rucola)	5
Allium tuberosum(Garlic chive, Nira)	4
Allium chinense (Japanese scallion, Rakkyo)	4
Brassica rapa var. perviridis(Komatsuna)	4
Brassica rapa L. var. hakabura(Nozawana)	4
Brassica rapa var. nipposinica(Potherb Mustard, Kyouna)	3
Gleditsia corneata(Crown daisy, Syungiku)	3
Raphanus sativus var. sativus(Radish)	3
Phaseolus vulgaris(Common bean, Ingen)	2
Solanum melongena(Eggplant, Nasu)	2
Brassica rapa(Nabana)	2
Brassica oleracea var. botrytis(Cauliflower)	2
Cichorium intybus(Chicory)	2

Vegetable Name	Sample Number
Akebia quinata(Chocolate Vine, Akebi)	1
Actinidia arguta(Kiwifruit)	1
Fortunella(Kumquat, Kinkan)	1
Castanea crenata(Japanese Chestnut, Kuri)	1
Allium fistulosum(Welsh onion, Hanegi)	1
Petasites japonicus(Fuki shoot, Fukinotsu)	1
Allium schoenoprasum var. foliosum(Asatsuki)	1
Glycine max(immature)(Edamame bean)	1
Abelmoschus esculentus(Okra)	1
Brassica rapa var. rapa(Turnip, Kabu)	1
Brassica rapa var. chinensis(Green pak choi, Chingensai)'	1
Momordica charantia var. pavel.(Bitter melon, Nigauri)	1
Allium macrostemon(Wild ocambole, Nobiru)	1
Petroselinum crispum(Parsley)	1
Allium x wakegi Araki(Wakegi)	1

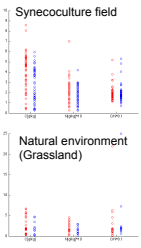
Vegetable Samples List

Soil Components

Soil component analysis of Synecoculture field and surrounding natural environment



—:Max appropriate range of Andosol(黒ボク土)
--:Min appropriate range of Andosol(黒ボク土)
(中央農業改良普及センター資料による)
○:0-10cm
○:30-40cm



Soil Parameter	Appropriate Range	Measured Value	Diagnostic Diagram
PH	5.5~6.5	5.3	
EC (mS/cm)	<0.30	0.2	
CEC (me)		19	
Base Saturation (%)	70.0~90.0	57.8	
Ca (mg/100g)	190.0~280.0	247.2	
Mg (mg/100g)	40.0~70.0	25.6	
K (mg/100g)	15.0~45.0	40.4	
Phosphoric Acid (mg/100g)	20.0~80.0	24.9	
Nitrate Nitrogen (mg/100g)	Total Nitrogen <5.0	6.0	
Ammonia Nitrogen (mg/100g)		2.8	
Humus (%)	>2.0	10.0	
Ca/Mg Ratio	2.0~8.0	6.9	
Mg/K Ratio	2.0~8.0	1.5	

Soil component analysis of main sampling farm
JAとぴあ浜松による伊勢協性農園の土壌診断結果

Diagnosis:
•"Soil PH is lower than the conventional standard. This may result in the deficiency of Ca, Mg, phosphoric acid and growth inhibition."
•"K is higher than Mg, which is expressed as low Mg/K ratio. This may reduce the uptake of Mg, as a result of antagonistic action between Ca, Mg, and K."

Morphology change of vegetables in Synecoculture

Conclusions

Although the soil minerals are not sufficient/unbalanced with respect to the conventional standard, vegetables raised under non-tillage, non-fertilizer condition tend to accumulate even superior dose of minerals in a long term. This results explain the optimization of conventional method is based on the quantity of harvest and not on the food components such as minerals, which is considered to play important role in long-term human health.

Acknowledgement

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