sustainability

MDPI

Supplementary material

Exploring the Trends in Nitrogen Input and Nitrogen Use Efficiency for Agricultural Sustainability

Table S1. Straw/yield ratio, straw N concentration , and recycling factor for each crop. The straws of different crops are differ in their recycling factors and nutrient contents. These parameters were used to estimate the N input from recycling of crop straw, and it was calculated by multiplying the straw production by straw N concentrations and the recycling factor for each crop. The crop straw production was estimated by multiplying crop yield data by straw/yield ratio for each crop.

Item name	Straw/yield ratio	Nitrogen concentration	Recycling factor	Reference
Almonds, with shell	1.0	1.06	0.42	*
Anise, badian, fennel, coriander	1.5	0.20	0.40	[24]
Apples	1.7	0.20	0.00	[24]
Apricots	1.7	0.20	0.00	[24]
Artichokes	1.7	0.20	0.20	[24]
Asparagus	1.7	0.20	0.20	[24]
Avocados	1.7	0.20	0.00	[24]
Bananas	1.7	0.20	0.00	[24]
Barley	1.5	0.43	0.45	[28]
Bastfibres, other	1.5	1.50	0.00	[24]
Beans, dry	1.5	1.47	0.45	[28]
Beans, green	1.7	0.20	0.20	[24]
Berries nes	1.7	0.20	0.00	[24]
Broad beans, horse beans, dry	1.5	0.43	0.45	[28]
Buckwheat	1.5	0.28	0.45	*
Cabbages and other brassicas	1.7	0.20	0.20	[24]
Carrots and turnips	1.7	0.20	0.20	[24]
Cashew nuts, with shell	1.0	1.06	0.42	[31]
Cassava	0.4	1.10	0.42	[24]
Castor oil seed	2.5	0.67	0.40	[24]
Cauliflowers and broccoli	1.7	0.20	0.20	[24]
Cereals, nes	1.5	0.67	0.30	*
Cherries	1.7	0.20	0.00	[24]
Chestnut	1.0	1.06	0.42	*
Chick peas	1.5	1.42	0.80	[28]
Chillies and peppers, green	1.7	0.20	0.20	[24]
Cinnamon (canella)	1.7	0.20	0.00	[24]
Cloves	1.7	0.20	0.00	[24]
Coconuts	1.0	1.06	0.42	[24]
Coffee, green	1.5	0.20	0.40	[24]
Cow peas, dry	1.5	1.42	0.80	[28]
Cucumbers and gherkins	1.7	0.20	0.20	[24]
Dates	1.7	0.20	0.00	[24]
Eggplants (aubergines)	1.7	0.20	0.20	[24]

Figs	1.7	0.20	0.00	[24]
Flax fibre and tow	1.5	1.50	0.00	[24]
Fruit, citrus nes	1.7	0.20	0.00	[24]
Fruit, fresh nes	1.7	0.20	0.00	[24]
Fruit, stone nes	1.7	0.20	0.00	[24]
Fruit, tropical fresh nes	1.7	0.20	0.00	[24]
Garlic	1.7	0.20	0.20	[24]
Ginger	1.7	0.20	0.20	[24]
Grapefruit (inc. pomelos)	1.7	0.20	0.00	[24]
Grapes	1.7	0.20	0.00	[24]
Groundnuts, with shell	1.0	1.06	0.42	[24]
Hazelnuts, with shell	1.0	1.06	0.42	*
Hemp tow waste	1.5	1.50	0.00	[24]
Hempseed	2.5	0.67	0.40	[24]
Hops	1.5	0.20	0.40	[24]
Jute	1.5	1.50	0.00	[24]
Kiwi fruit	1.7	0.20	0.00	[24]
Leeks, other alliaceous vegetables	1.7	0.20	0.20	[24]
Lemons and limes	1.7	0.20	0.00	[24]
Lentils	1.5	0.43	0.45	[28]
Lettuce and chicory	1.7	0.20	0.20	[24]
Linseed	2.5	0.67	0.40	[24]
Maize	1.0	0.81	0.20	[26]
Maize, green	1.7	0.20	0.20	[24]
Mangoes, mangosteens, guavas	1.7	0.20	0.00	[24]
Melons, other (inc.cantaloupes)	1.7	0.20	0.00	[24]
Melonseed	2.5	0.67	0.40	[24]
Millet	1.5	0.67	0.30	[26]
Mushrooms and truffles	1.7	0.20	0.20	[24]
Mustard seed	2.5	0.67	0.40	[24]
Nuts, nes	1.0	1.06	0.42	[31]
Oats	1.0	0.70	0.45	[26]
Oil, palm fruit	2.5	0.67	0.40	[24]
Onions, dry	1.7	0.20	0.20	[24]
Onions, shallots, green	1.7	0.20	0.20	[24]
Oranges	1.7	0.20	0.00	[24]
Papayas	1.7	0.20	0.00	[24]
Peaches and nectarines	1.7	0.20	0.00	[24]
Pears	1.7	0.20	0.00	[24]
Peas, dry	1.5	1.42	0.80	[28]
Peas, green	1.7	0.20	0.20	[24]
Pepper (piper spp.)	1.7	0.20	0.20	[24]
Persimmons	1.7	0.20	0.00	[24]
Pineapples	1.7	0.20	0.00	[24]
Pistachios	1.0	1.06	0.42	*
Plums and sloes	1.7	0.20	0.00	[24]
Potatoes	0.4	1.10	0.42	[24]

Pulses, nes	1.5	0.43	0.45	[28]
Pumpkins, squash and gourds	1.7	0.20	0.20	[24]
Quinces	1.7	0.20	0.00	[24]
Ramie	1.5	1.50	0.00	[24]
Rapeseed	2.5	0.67	0.40	[24]
Rice, paddy	1.5	0.67	0.30	[26]
Roots and tubers, nes	0.4	1.10	0.42	[24]
Rubber, natural	1.5	0.20	0.40	[24]
Rye	1.5	0.28	0.45	[26]
Safflower seed	2.5	0.67	0.40	[24]
Seed cotton	1.5	1.50	0.00	[24]
Sesame seed	2.5	0.67	0.40	[24]
Sisal	1.5	1.50	0.00	[24]
Sorghum	1.5	0.28	0.45	[26]
Soybeans	2.1	1.50	0.80	[30]
Spices, nes	1.5	0.20	0.40	[24]
Spinach	1.7	0.20	0.20	[24]
Strawberries	1.7	0.20	0.00	[24]
Sugar beet	0.2	1.80	0.42	[29]
Sugar cane	0.8	0.40	0.42	[29]
Sunflower seed	2.5	0.67	0.40	[24]
Sweet potatoes	0.4	1.10	0.42	[24]
Tallowtree seed	2.5	0.67	0.40	[24]
Tangerines, mandarins, clementines, satsumas	1.7	0.20	0.00	[24]
Taro (cocoyam)	0.4	1.10	0.42	[24]
Tea	1.5	0.20	0.40	[24]
Tobacco, unmanufactured	1.5	0.20	0.40	[24]
Tomatoes	1.7	0.20	0.20	[24]
Triticale	1.5	0.28	0.45	*
Tung nuts	1.0	1.06	0.42	[24]
Vanilla	1.5	0.20	0.40	[24]
Vegetables, fresh nes	1.7	0.20	0.20	[24]
Vegetables, leguminous nes	1.7	0.20	0.20	[24]
Walnuts, with shell	1.0	1.06	0.42	*
Watermelons	1.7	0.20	0.00	[24]
Wheat	1.5	0.28	0.45	[26]

* By analogy to similar items

Table S2. The area-based N fixation coefficients of 117 primary crops. To estimate the crop biological N fixation by fixing crops included in the FAOSTAT database, we used an area-based N fixation coefficient of each crop. For most crops, we used global mean values, as no clear regional differences were apparent. The N input from biological N fixation was estimated by multiplying sowing area and its corresponding area-based N fixation coefficient.

Item name	Biofixation
Almonds, with shell	0.4*
Anise, badian, fennel, coriander	15*
Apples	0.4*
Apricots	0.4*
Artichokes	15*
Asparagus	15*
Avocados	0.4*
Bananas	0.4
Barley	80
Bastfibres, other	15*
Beans, dry	98
Beans, green	154
Berries nes	0.4*
Broad beans, horse beans, dry	100
Buckwheat	15*
Cabbages and other brassicas	15*
Carrots and turnips	15*
Cashew nuts, with shell	0.4*
Cassava	15*
Castor oil seed	79*
Cauliflowers and broccoli	15*
Cereals, nes	15
Cherries	0.4*
Chestnut	0.4*
Chick peas	34
Chillies and peppers, green	15*
Cinnamon (canella)	0.4*
Cloves	0.4
Coconuts	79
Coffee, green	15*
Cow peas, dry	22
Cucumbers and gherkins	15*
Dates	0.4
Eggplants (aubergines)	15*
Figs	0.4
Flax fibre and tow	15*
Fruit, citrus nes	0.4*
Fruit, fresh nes	0.4
Fruit, stone nes	0.4
Fruit, tropical fresh nes	0.4
Garlic	15*

Ginger	15*
Grapefruit (inc. pomelos)	0.4
Grapes	0.4*
Groundnuts, with shell	79*
Hazelnuts, with shell	0.4*
Hemp tow waste	15*
Hempseed	79*
Hops	15*
Jute	15*
Kiwi fruit	0.4*
Leeks, other alliaceous vegetables	15*
Lemons and limes	0.4*
Lentils	54
Lettuce and chicory	15*
Linseed	79
Maize	15*
Maize, green	15*
Mangoes, mangosteens, guavas	0.4*
Melons, other (inc.cantaloupes)	0.4*
Melonseed	79
Millet	15*
Mushrooms and truffles	15*
Mustard seed	79*
Nuts, nes	0.4
Oats	15*
Oil, palm fruit	79
Onions, dry	15*
Onions, shallots, green	15*
Oranges	0.4*
Papayas	0.4*
Peaches and nectarines	0.4*
Pears	0.4*
Peas, dry	63
Peas, green	48
Pepper (piper spp.)	15*
Persimmons	0.4*
Pineapples	0.4*
Pistachios	0.4*
Plums and sloes	0.4*
Potatoes	15*
Pulses, nes	24
Pumpkins, squash and gourds	15*
Quinces	0.4*
Ramie	15*
Rapeseed	79
Rice, paddy	33
Roots and tubers, nes	15*

Rubber, natural	15*
Rye	15
Safflower seed	79
Seed cotton	15*
Sesame seed	79
Sisal	15*
Sorghum	15*
Soybeans	98*
Spices, nes	15*
Spinach	15*
Strawberries	0.4*
Sugar beet	25
Sugar cane	25
Sunflower seed	79
Sweet potatoes	15*
Tallowtree seed	79*
Tangerines, mandarins, clementines, satsumas	0.4*
Taro (cocoyam)	15*
Tea	15
Tobacco, unmanufactured	15
Tomatoes	15*
Triticale	15
Tung nuts	79*
Vanilla	15
Vegetables, fresh nes	15
Vegetables, leguminous nes	33
Walnuts, with shell	0.4*
Watermelons	0.4*
Wheat	15

* By analogy to similar items