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STICHTING ONDERZOEK WERELDVOEDSEL

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THE CONCENTRATIONS OF MACRO-ELEMENTS IN
ECONOMIC PRODUCTS AND RESIDUES OF
(SUB)TROPICAL FIELD CROPS

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CENTRE FOR WORLD FOOD STUDIES
Amsterdam-Wageningen

Minimum and maximum N, P and K concentrations in economic products and crop residues of (sub)tropical crops obtained from the literature. Concentrations in the residues are between brackets if the concentrations in the residues and economic products are from different crops. Harvest Indices (HI) are expressed in dry matter and in percentages. Haulms are defined as stems and leaves. Shelling is the seed/pod percentage. D.M. % indicates the dry matter concentration.

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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SUIKERBIET

Amus et al (1982)			
root	1,06 - 1,35	0,17 - 0,18	0,97 - 1,37
leaves	2,20 - 2,77	0,26 - 0,28	3,59 - 3,74
Beeson (1941)			
root		0,03 - 0,33	
leaves		(0,00 - 0,38)	
Boguslawski et al (1961)			
root			0,60 - 0,70
leaves			(3,20 - 4,30)
Brouwer (1976)			
root		0,10 - 0,16	0,43 - 1,45
Clarck et al (1978)			
root		0,12 - 0,15	
top		0,26 - 0,35	
Draycott (1973)			
root			0,60 - 1,00
leaves			(1,70 - 3,90)
Draycott (1973)			
root	0,63 - 0,85		
top	2,45 - 2,92		
Draycott (1973)			
root			
top			
Greenwood (1980)			
root	0,66 - 1,30	0,15 - 0,19	0,63 - 0,74
leaves	1,96 - 2,64	0,26 - 0,40	2,10 - 2,64
Hale (1945)			
leaves			0,43 - 0,00
Hills et al (1983)			
root	0,74 - 0,93		
leaves	2,39 - 2,40		
Hirst et al (1944)			
root			
leaves		0,05 - 0,10	
Last et al (1979)		(0,07 - 0,10)	
root	0,50 - 0,96		
top	2,42 - 2,92	0,13 - 0,14	
Lorenz et al (1980)		0,22 - 0,25	
root		0,13 - 0,13	
Loue (1972)			
root			
leaves			0,60 - 1,00
Loue (1985)			3,50 - 3,50

root	0,63-0,63	0,15-0,15	0,70-0,70
top	1,42-1,42	0,21-0,21	1,17-1,17
leaves	2,12-2,12	0,32-0,32	3,76-3,76
Ludecke et al (1957)			
root			0,70-0,70
leaves			3,50-3,50
Maidl et al (1982)			
leaves	0,63-1,34		
McEwen et al (1979)			
root	0,97-1,01	0,15-0,17	0,96-1,03
top	2,47-2,49	0,20-0,32	3,83-3,86
Rinno et al (1974)			
root	0,62-1,10		
leaves	2,53-3,54		
Schmehl et al (1953)			
leaves		0,20-0,21	
Smiths et al (1973)			
root	0,51-0,81		
top	1,47-1,89		
Veen van der (1984)			
root	0,61-1,25	0,13-0,17	0,79-1,37
Winner et al (1977)			
root	0,69-1,03		
leaves	2,62-3,00		

Top = blad + kop

DN-distribution (Lue, 85)
 blad 1,463
 kop 1,45
 wortel 12,836

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Appendix

Minimum and Maximum N, P and K concentrations in economic products and crop residues of (sub)tropical field crops obtained from literature. Concentrations are between brackets if they are from different crops.

Reference Crop crop part	N min-max %	P min-max %	K min-max %
<u>Chillies</u>			
Bagyaraj et al (1982) straw		0.11-0.20	
Dadhich et al (1969) straw	2.00-3.03		
Ferrari (1972) fruits	2.90-3.33		
Hoskins (1976) fruits			2.73-4.02
Howard et al (1962) fruits	2.29-2.29	0.33-0.33	1.86-1.86
Kariman-Terani et al (1983) fruits			1.88-1.88
straw			1.59-2.08
Knott et al (1967) fruits	3.19-3.68	0.27-0.50	1.25-1.42
Lewis (1984) fruits	2.58-2.58		
Maistre (1964) fruits	2.75-2.75	0.46-0.46	3.01-3.01
Maurya et al (1984) fruits	3.19-3.68	0.24-0.27	1.25-1.42
Misra et al (1972) fruits	1.49-1.54		
Sarudi et al (1939) fruits		0.41-0.41	3.39-3.39
Westphal (1976) fruits	2.82-2.82		
Yamaguchi (1983) fruits	2.00-2.29	0.28-0.33	

Yamaguchi (1983)

fruits ~~2.00-2.29~~ ~~0.28-0.33~~

Other Capsium spp. (sweet and bell peppers)

Albasel et al (1984)

fruits 1.90-2.70
straw 1.38-1.85

El Sherbim (1980)

fruits 3.34-3.34 0.46-0.46 3.46-3.46
straw 2.93-2.93 0.33-0.33 5.91-5.91

Kaufmann et al (1971)

fruits 2.82-3.01 0.37-0.39 3.18-3.38
straw (2.54-2.71) (0.18-0.21) (2.94-3.12)

Miller et al (1979)

fruits 2.20-2.20 0.32-0.32 2.50-2.50

5

straw 2.30-2.30 0.35-0.35 2.80-2.80

Miller et al (1961)

fruits 1.58-3.30 0.22-0.44 1.84-3.38
straw 1.09-4.93 0.12-0.40 1.00-4.64

Somos (1984)

fruits 2.39-3.00 0.40-0.61 1.91-3.19
straw (1.32-3.85) (0.22-0.65) (2.04-5.29)

Spaldon et al (1968)

fruits 4.06-4.74 0.21-0.76 5.12-6.95
straw 3.13-3.19 0.11-0.32 3.95-3.98

Thomas et al (1967)

fruits 2.25-2.47 0.34-0.46
straw 2.24-2.24 0.18-0.18

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INTRODUCTION

In order to be able to predict crop yields in situations that crop growth is limited by nutrient availability, a system for quantitative evaluation of the fertility of tropical soils (QUEFTS) has been developed by Janssen et al (1986 and 1987). This system is integrated in the crop growth simulation model of the Centre for World Food Studies. The resulting simulation program can be used for the calculation of the potential, the water-limited as well as nutrient-limited crop production.

The inputs required for the application of the QUEFTS system are, apart from chemical soil data, the minimum and maximum concentrations of the macronutrients N, P and K in the economic product of a crop and its residues. Initially these data were established for maize only, as QUEFTS was originally developed for this crop. However, QUEFTS can be adapted to any crop if the ranges in N, P and K concentrations in residues and economic products are known. Up to now, such data have not been thoroughly collected by the Centre for World Food Studies and part of the data used were mainly estimates. The object of this study was to provide more reliable data on the ranges in N, P and K concentrations from literature.

METHODS

A large number of articles with data on the N, P and K concentrations in different crops is reviewed. These data are used to establish the minimum and maximum nutrient concentrations. They are derived for mature (i.e. to be harvested), complete plants (excluding roots) and the corresponding concentrations in economic products and residues are determined afterwards (see Table 1.) Extreme high or low concentrations are often found in one part of the crop, but are only used as minimum or maximum concentrations if they are accompanied by high or low concentrations in the other crop parts. The established ranges cover 90% of the values found, i.e. the upper and lower extremes are excluded.

Correlations between the nutrient concentrations in economic products and residues are computed for crops such as jute, sugarcane and tobacco, as they have stems and leaves as economic products. Correlations between the N and P content in a plant part are computed for all crops. Both types of correlations, if they proved to be strong, are used to determine the range of concentrations respectively in the least documented plant part and of the least documented nutrient.

RESULTS

The values for the minimum and maximum N, P and K concentrations in the different crops are presented in Table 1.

Information on the K content in the residues of a number of legumes (cowpea, broad beans, chickpea and lentils) is rare. Therefore, the K content in the residues of these pulses is estimated. There is also a lack of information on the nutrient concentrations in sesame, and, to a less extent, for lentils, jute and kenaf. The average dry weight fractions of the parts of the bolls of cotton is also given in Table 1.

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Table 1. Nutrient concentration in economic products and crop residues for a number of (sub)tropical field crops, as fraction of N, P and K on dry matter basis.

crop organ	N min-max %	P min-max %	K min-max %
Cereals			
Barley			
grain	1.10-4.30	0.16-0.60	0.30-1.10
straw	0.30-2.20	0.04-0.50	0.75-2.90
Maize			
grain	0.90-2.20	0.16-0.80	0.17-0.60
straw	0.40-1.40	0.04-0.40	0.40-2.40
Millet (Fingermillet)			
grain	0.80-3.85	0.12-0.80	0.20-0.50
straw	0.32-1.00	0.04-0.70	0.90-3.60
Millet (pearlmillet)			
grain	0.95-3.20	0.15-0.90	0.30-0.80
straw	0.40-1.00	0.05-0.35	1.00-2.40
Rice			
grain (<i>brown rice</i>)	0.80-2.90	0.09-0.60	0.23-0.80
straw	0.30-1.80	0.03-0.20	0.65-2.80
Sorghum			
grain	1.00-3.20	0.13-0.65	0.25-0.70
straw	0.35-1.20	0.05-0.30	0.80-2.80
Wheat			
grain	1.00-3.30	0.16-0.60	0.30-0.80
straw	0.40-1.05	0.03-0.45	0.70-2.70
Legumes			
(<i>Field</i>) Broad Bean			
seeds	3.00-4.90	0.26-0.60	0.80-2.10
straw	0.80-2.30	0.08-0.40	0.85-3.70
Chickpea			
seeds	2.00-5.00	0.27-0.80	0.60-1.20
straw	0.70-1.70	0.06-0.32	0.85-3.70
Cowpea			
seeds	2.90-4.70	0.20-0.60	0.90-1.80
straw	0.75-2.70	0.08-0.30	0.85-3.70
Groundnuts			
seeds	2.70-6.30	0.12-0.60	0.40-1.60
straw	1.00-1.80	0.08-0.20	0.90-3.40
Lentils			
seeds	3.20-5.40	0.14-0.50	0.60-1.30
straw	0.90-2.50	0.08-0.35	0.85-3.70
Mungbeans			
seeds	2.70-4.80	0.20-0.50	0.60-1.50
straw	0.80-4.60	0.10-0.40	1.00-4.40
Peas			
seeds	2.50-5.80	0.25-0.70	0.70-2.20
straw	1.00-2.90	0.06-0.35	0.80-3.50

Table 1. cont.

Crop organ	N min-max %	P min-max %	K min-max %
Soybeans			
seeds	4.60-7.60	0.35-1.00	1.40-2.30
straw	0.40-1.70	0.10-0.50	0.60-3.00
Root and Bulb Crops			
Cassava			
tubers	0.20-0.90	0.08-0.24	0.30-1.40
tops	0.50-1.80	0.09-0.55	0.45-1.80
Onions			
bulbs	0.80-3.10	0.16-1.20	0.70-1.80
leaves	1.40-3.40	0.14-1.20	0.70-4.90
Potato			
tubers	0.90-2.50	0.10-0.60	1.10-4.60
tops	1.40-3.20	0.13-1.00	0.85-4.60
Sweet Potato			
tubers	0.28-1.55	0.07-0.33	0.60-2.30
tops	1.00-3.60	0.13-0.45	1.40-4.85
Fibre Plants			
Cotton			
floral parts	1.30-2.50	0.20-0.80	0.70-2.20
burs (30% DW)	0.50-1.80	0.10-0.34	1.00-4.80
seeds (42% DW)	2.95-6.60	0.40-1.40	1.00-5.70
lint (28% DW)	0.12-0.34	0.03-0.14	0.28-0.65
straw	0.80-2.20	0.08-0.63	0.50-2.20
Jute			
stems	0.30-1.00	0.08-0.23	0.80-1.40
leaves	1.50-4.30	0.22-0.50	1.35-2.50
Kenaf			
stems	0.20-1.70	0.07-0.25	0.80-2.30
leaves	1.10-3.80	0.13-0.32	0.85-2.45
Oil plants			
Rapeseed			
seeds	2.00-6.70	0.40-1.30	0.50-1.45
straw	0.50-1.60	0.06-0.20	0.95-2.45
Sesame			
capsules	1.60-2.10	0.25-0.35	1.10-1.90
straw	0.90-1.20	0.25-0.82	1.20-2.40
Sunflower			
seeds	1.80-4.70	0.35-1.35	0.60-2.40
straw	0.55-1.90	0.07-0.40	0.90-4.70
Miscellaneous Crops			
Sugarcane			
stem	0.09-0.50	0.04-0.16	0.30-1.50
leaves	0.55-1.70	0.10-0.30	0.40-2.40
Tobacco			
leaves	1.00-4.70	0.14-0.60	0.60-5.70
stems	0.55-2.80	0.12-0.60	1.10-4.60

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Maize

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Appendix

Minimum and Maximum N, P and K concentrations in economic products and crop residues of (sub)tropical field crops obtained from literature. Concentrations are between brackets if they are from different crops.

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Barley			
Alahmad, M. (1981)			
grain	1.72-2.94	0.23-0.35	0.87-1.40
straw	0.42-2.85	0.06-0.22	1.48-2.95
Alessi, J. (1973)			
grain	1.71-2.24		
straw	0.52-0.96		
Andersen, A.J. et al (1983)			
grain	1.58-1.77		
straw	0.49-0.64		
Bajwa, M.A. et al (1981)			
grain	1.08-2.02	0.18-0.38	0.59-0.60
straw	0.25-0.71	0.03-0.11	1.81-2.10
Beeson, K.C. (1941)			
grain		0.15-0.62	
straw		(0.04-0.56)	
Bucher, R. von et al (1982)			
grain			0.56-0.56
straw			1.15-1.99
Chojnacki, A. et al (1971)			
grain	1.16-2.29	0.27-0.59	0.43-0.62
straw	(0.37-0.70)	(0.09-0.19)	(0.98-1.99)
Dam Kofoed, A. (1978)			
grain			0.41-0.45
straw			0.66-0.85
Eakin, J.H. (1972)			
grain	1.82-1.82	0.36-0.36	0.45-0.45
straw	0.68-0.68	0.12-0.12	1.20-1.20
Fedak, G. (1977)			
grain	1.58-2.29		0.19-0.20
straw	0.37-1.18	0.05-0.15	0.93-2.78
Gately, T.F. et al (1976)			
grain	1.49-2.42		
straw	0.51-0.93		
Graeves, J.E. et al (1946)			
grain		0.32-0.44	
Jenkins, G. et al (1979)			
grain	1.28-2.19		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Johnston, A.E. et al (1976)			
grains		0.25-0.45	
straw		0.04-0.18	
Kleese, R.A. (1968)			
grain		0.38-0.45	0.51-0.68
McGuire, C.F. (1979)			
grain	2.06-3.02		
Orphanos, P.I. et al (1980)			
grains	1.71-2.34		0.56-0.56
straw	0.49-0.75		1.51-2.36
Rhodes, A.P. et al (1974)			
grain	1.10-4.82		
Smetankova, M. (1973)			
grain	1.64-2.06	0.44-0.48	0.64-0.69
straw	0.55-0.67	0.06-0.10	1.82-2.32
Sonntag, C. et al (1973)			
grain	1.40-4.10		
Timmermann, F. et al (1976)			
grain	1.76-2.21	0.45-0.52	0.49-0.61
straw	0.48-1.02	0.21-0.31	0.90-1.65
Torp, J. (1979)			
grain	1.49-1.93		
Walker, D.R. (1975)			
grain	1.12-2.69		
Widdowson, F.W. (1972)			
grain	1.34-1.97		
Maize			
Allison, J.C.S. et al (1984)			
grain	1.30-1.90		
straw	0.47-0.76		
Atanasiu, N. et al (1978)			
grain		0.58-0.66	
straw		0.08-0.09	
Balasubramanian, V. (1982)			
grain	1.14-1.47		
straw	0.30-0.42		
Beeson, K.C. (1941)			
grain		0.23-0.80	
straw		(0.04-0.42)	
Chaundhay T.N. et al (1975)			
grain	1.22-1.44	0.23-0.26	0.40-0.49
straw	0.57-0.67	0.04-0.05	1.21-1.34
Dass, B. et al (1979)			
grain	1.16-1.88	0.21-0.30	0.16-0.22
straw	0.22-0.97	0.04-0.16	0.46-1.31
Eakin, J.H. (1972)			
grain	1.96-2.41	0.39-0.48	
straw	1.44-1.44	0.14-0.14	

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Hanway, J.J. (1962) grain	1.42-1.99		
Jones, C.A. (1983; literature review) grain	0.90-2.09		
straw	0.41-1.28		
Jordan, H.V. (1950) grain	1.44-1.95	0.21-0.42	0.36-0.36
straw	0.62-1.04	0.11-0.18	1.17-1.99
Kang, B.T. et al (1979) grain		0.29-0.43	
straw		0.08-0.11	
Kang, B.T. et al (1977) grain		0.17-0.40	
straw		0.03-0.09	
Loue, A. (1963; literature review) grain	0.96-2.21	0.40-0.90	0.32-0.69
straw	0.44-1.06	0.07-0.43	0.33-2.04
Olson, L.J. (1976) grain	1.06-1.46		
Perry, L.J. (1975) grain	1.10-1.54		
Pierre, W.H. (1977) grain	0.94-1.80		
Sparks, D.L. et al (1980) grain			0.17-0.44
straw			0.72-2.46
Steele, K.W. et al (1982) grain	0.75-1.77		
Suwanarit, A. (1975) grain	1.62-2.03	0.36-0.43	
straw	0.48-0.61	0.03-0.05	
Touchton, J.T. et al (1979) grain	1.44-2.17		
grain		0.16-0.24	0.40-0.49
straw		0.40-0.40	1.21-1.35
grain	1.15-1.84	0.42-0.76	0.40-0.49
grain	1.57-1.57	0.28-0.28	0.39-0.39
straw	1.00-1.00	0.17-0.17	1.23-1.23
Millets			
fingermillet			
Doss, A.K. (1975) grain	0.98-5.61	0.20-0.48	0.17-0.21
straw	1.13-1.50	0.16-0.71	0.85-1.21

Reference Crop Crop part	N min-max %	P min-max %	K min-max %
Ekambaram, S. (1975)			
grain			0.43-0.51
straw			2.31-3.64
Hulse, J.H. et al (1980; literature review)			
grain	0.72-2.08	0.13-0.89	
Joshi, H.C. (1979)			
grain	1.10-1.84		
Kumaraswang, K. et al (1974; pot experiment)			
grain		0.16-0.37	
straw		0.03-0.06	
Muthuvel, P. (1978)			
grain		0.18-0.31	
straw		0.07-0.40	
Pore, M.S. et al (1979)			
grain	0.92-1.30	0.11-0.22	0.37-0.50
Pore, M.S. et al (1977)			
grain	1.14-1.70	0.16-0.28	
Rajaram, S. et al (1983)			
grain	1.13-1.47		
pearlmillet			
Anon. (1981)			
grain	1.35-1.59		
straw	0.32-0.46		
Bailey, A.V. (1979)			
grain	1.71-2.74	0.38-0.89	0.37-0.86
Ganry, F. (1978)			
grain	1.22-1.24		
straw	0.44-0.72		
Gigou, J. et al (1985)			
grain	2.58-3.01		
Godawat, S.L. (1981)			
grain	1.62-2.85		
Hulse, J.H. et al (1980; literature review)			
grain	1.07-3.49	0.13-0.96	0.34-0.81
ICRISAT (1976)			
grain	0.82-2.91		
Lal, R. (1979)			
grain	1.80-2.34		
straw	0.55-0.79		
Pieri, C. (1983)			
grain	1.60-1.81	0.21-0.26	0.41-0.56
straw	0.30-0.90	0.05-0.05	1.08-1.76
Pieri, C. (1982)			
straw			1.00-2.45
Singh, J.P. (1979)			
grain	1.69-1.99	1.21-1.34	0.49-0.73
Upasani, R.K. (1980)			
grain	1.68-2.05		
straw	0.96-1.06		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
<hr/>			
Rice (<i>Brown rice</i>)			
Agarwal, B. (1980)			
grain	1.46-1.66	0.26-0.30	0.29-0.35
straw	0.55-0.63	0.10-0.13	1.18-1.31
Basak, M.N. (1962)			
grain	0.95-2.04		
Beye, G. (1973)			
grain		0.07-0.22	
straw		0.02-0.05	
Bhushan, L.E. et al (1979)			
grain	1.12-1.24	0.13-0.19	
straw	0.39-0.49	0.10-0.13	
Bredero, T.J. (1965)			
grain	0.99-1.38	0.24-0.27	0.36-0.39
straw	0.42-0.99	0.05-0.12	1.99-2.89
Eid, M.T. et al (1974)			
grain	1.03-1.04	0.16-0.27	
straw	0.46-0.49	0.10-0.11	
Esakkimutha, N. et al (1975)			
grain	1.69-2.82		0.56-0.75
straw	0.84-2.80		0.62-2.00
International Atomic Energy Agency (1978)			
grain	0.81-3.06		
straw	0.26-1.41		
Kothandaroman, G.V. (1975)			
grain	0.90-1.85		
Kurten, P.W. (1969)			
grain	1.00-1.20	0.20-0.26	0.21-0.42
straw	(0.50-0.60)	(0.04-0.17)	(0.71-0.83)
Lusanandana, B. et al (1966)			
grain	0.86-0.99		
straw	0.32-0.40		
Mahapatra, I.C. (1972)			
grain	0.87-1.17	0.15-0.19	0.25-0.70
straw	0.61-0.96	0.12-0.18	0.70-1.47
Majumdar, D.K. (1973)			
grain	1.11-1.32	0.22-0.23	
straw	0.42-0.49	0.13-0.14	
Patnaik, S. (1969; pot experiment)			
grain		0.10-0.22	0.25-0.36
straw		0.03-0.06	1.11-1.49
Patnaik, S. (1968)			
grain	0.80-1.55		
straw	0.34-0.95		
Reddy K.R. et al (1978)			
grain	0.94-0.95		
straw	0.52-0.59		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Reddy K.R. et al (1976)			
grain	0.98-1.13		
straw	0.42-0.51		
Sadanandan, A.K. (1980)			
grain		0.15-0.88	
Singh, M. (1981; pot experiment)			
grain	0.89-1.17		
straw	0.32-0.43		
Sinka, S.B. (1980)			
grain		0.22-0.35	
straw		0.05-0.08	
Subbiak, S. et al (1979)			
grain	0.98-1.16	0.26-0.37	0.49-0.58
straw	0.62-0.77	0.09-0.16	1.25-1.39
Thandapani, V. et al (1974)			
grain	1.60-2.10	0.36-0.39	0.70-0.80
straw	1.18-1.37	0.05-0.06	2.45-2.80
Sorghum			
Boguslawski, E. et al (1965)			
grain	1.55-2.47	0.33-0.42	0.38-0.44
straw	0.38-0.95	0.10-0.33	1.19-1.67
Herron, G.M. et al (1963)			
grain	1.02-1.55		
straw	0.36-0.73		
Hulse, J.H. et al (1980; literature review)			
grain	0.88-4.32	0.13-0.66	0.22-0.49
Jones, C.A. (1983; literature review; see also Herron)			
grain	1.02-3.20		
straw	0.36-1.28		
Perry, L.J. (1975)			
grain	1.07-1.91		
Pieri, C. (1983)			
grain	1.32-1.32	0.23-0.31	0.27-0.37
straw	0.29-0.37	0.05-0.08	0.52-1.11
Roy, R.N. et al (1973)			
grain	1.56-2.12		
straw	0.54-0.75		
Sadaphal, M.N. (1971)			
grain	1.75-2.18		
straw	0.40-0.43		
Sirivastavan, S.P. (1971)			
grain		0.52-0.63	
straw		0.17-0.20	
Turkhede, B.B. (1980)			
grain		0.14-0.24	
straw		0.06-0.09	

Reference Crop crop part	N min-max %	P min-max %	K min-max %
<hr/>			
Wheat			
Alessi, J. (1973)			
grain	3.13-3.57		
Alston, A.M. (1980)			
grain		0.24-0.53	
Balasubramanian, V. et al (1982)			
grain	1.62-1.78		
straw	0.29-0.31		
Beeson, K.C. (1941)			
grain		0.15-0.54	
straw		(0.03-0.17)	
Bucher, R von et al (1982)			
grain			0.37-0.52
straw			0.78-1.02
Christensen, N.W. (1981)			
grain	1.82-2.19		
straw	0.28-0.40		
Colwell, J.D. (1963)			
grain	1.06-2.53	0.17-0.48	
Eakin, J.H. (1972)			
grain	2.07-2.07	0.48-0.48	0.52-0.52
straw	0.58-0.58	0.08-0.08	0.87-0.87
Eid, M.T. et al (1974)			
grain	1.31-1.73	0.26-0.37	
straw	0.34-0.35	0.15-0.17	
Greaves, J.R. (1946)			
grain		0.39-0.46	
Greenwood, J.D. et al (1980)			
grain		0.34-0.34	
straw		(0.10-0.11)	
Hakeem, A.M. et al (1981)			
grain	1.81-2.38		
straw	0.44-0.58		
Hamid, A. et al (1977)			
grain		0.20-0.28	
straw		0.03-0.04	
Hamid, A. et al (1976)			
grain	1.54-2.32		
straw	0.22-0.38		
Hamid, A. et al (1973)			
grain	1.66-2.16		
straw	0.25-0.41		
Khetawat, G.K. (1972)			
grain	1.69-2.15	0.36-0.51	0.46-0.46
straw	0.43-0.53	0.06-0.10	1.45-1.86
Kleese, R.A. et al (1968)			
grain		0.45-0.53	0.39-0.56
Lal, P. et al (1974)			
grain	1.56-2.21	0.35-0.38	0.67-0.75
straw	0.39-0.85	0.06-0.08	1.50-2.11

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Lipsett, J. (1964; pot experiment)			
grain		0.16-0.55	
Mohamed, G.E.S. (1979)			
grain		0.25-0.30	
Nitant, H.C. et al (1974)			
grain	1.00-2.06		
straw	0.43-0.68		
Olson, R.O. et al (1976)			
grain	1.44-2.11		
Orphanos P.I. et al (1980)			
grain	2.11-3.15		0.44-0.44
straw	0.39-0.75		0.68-1.48
Primost, E. (1969)			
grain		0.35-0.36	
straw		0.05-0.06	
Raez, G.J. et al (1965)			
grain	2.60-3.00	0.38-0.52	
straw	0.70-1.40	0.07-0.14	
Singh, G. (1962)			
grain		0.91-1.00	
Stibbe, E. et al (1973)			
grain		0.32-0.32	
straw		0.04-0.04	
Talati, N.R. (1974)			
grain			0.38-0.41
straw			2.08-2.91
Wolnik, K.A. et al (1983)			
grain		0.16-0.68	0.30-0.83
Broad Bean			
Beeson, K.C. (1941)			
seeds		0.26-0.78	
straw		(0.08-0.17)	
Chojnacki, A. et al (1971)			
seeds	4.58-4.80		
straw	(1.62-1.62)		
Edje, O.T. et al (1975)			
seeds	2.94-3.97		
Fellmann, K. (1985)			
seeds	3.06-4.00		
straw	0.70-1.30		
Furr, A.K. et al (1976)			
seeds			1.63-1.95
Hove, E.L. et al (1976)			
seeds	4.00-4.80		
Kerr, J.C. (1972)			
seeds	4.63-5.58		
Lauer, D.A. (1982)			
seeds	2.92-3.54	0.39-0.60	1.38-2.17

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Lolas, G.M. et al (1975)			
seeds	3.05-4.14	0.26-0.56	
McKenzie, D.B. et al (1983)			
seeds		0.44-0.52	
straw		0.30-0.46	
Meiners, C.R. et al (1976)			
seeds	3.53-3.94	0.37-0.51	0.82-1.30
Peck, N.H. et al (1980)			
seeds		0.26-0.40	
Peck, N.H. (1978)			
seeds		0.25-0.33	0.80-1.20
Rennie, R.J. et al (1983)			
seeds	2.94-4.51		
Ries, S.K. (1971)			
seeds	3.50-4.35		
Roberts, S. et al (1971)			
seeds	3.78-4.41		
straw	1.78-2.65		
Robinson, R.G. (1983)			
seeds	3.17-4.99		
Ruschel, A.P. et al (1982)			
seeds	3.92-4.25		
straw	1.39-2.53		
Schroeder, M. (1980)			
seeds	3.32-3.77		
straw	1.89-3.52		
Timmermann, F. et al (1976)			
seeds			1.33-1.54
Westermann, D.T. et al (1985)			
seeds	3.01-3.45		
straw	0.97-1.17		
Whiteaker, G. et al (1976)			
seeds		0.48-0.60	

Chickpea

Argikar (1970)	
seeds	4.05-4.62
Bingh, R.S. (1970)	
seeds	2.36-2.61
Evans, J. (1982)	
seeds	3.25-3.63
straw	1.58-1.95
FAO (1977)	
seeds	1.98-4.50
Hardallou, E. et al (1981)	
seeds	2.12-2.78
ICRISAT (1980)	
seeds	2.51-4.37

Reference Crop crop part	N min-max %	P min-max %	K min-max %
ICRISAT (1978)			
seeds	2.64-3.70		
ICRISAT (1976)			
seeds	2.19-4.19		
Jambunathan, R. (1979)			
seeds	2.83-4.88		
Kadam, S.S. et al (1977)			
seeds	5.09-5.33		
Kapoor, K.K. et al (1977)			
seeds	3.27-3.30		
straw	1.10-1.17		
Kuzayli, M.V. et al (1966)			
seeds	3.47-3.47	0.41-0.41	
Maesen, L.J.G. van (1972)			
seeds	2.02-5.06	0.19-0.59	
Mahajan, J.P. (1985)			
seeds		0.29-0.37	
straw		0.06-0.10	
Meiners, C.R. et al (1976)			
seeds	3.22-3.54	0.31-0.40	0.63-0.75
Monti, L.M. (1983)			
seeds	2.38-4.74		
Prasad, J. (1981)			
seeds	3.67-4.21		
Singh, D.V. et al (1978)			
seeds	2.52-2.92	0.40-0.88	
straw	0.72-0.82	0.06-0.12	
Singh, R.G. (1971)			
seeds	4.52-4.79	0.36-0.51	
straw	1.11-1.38	0.19-0.32	
Tiwari, S.R. et al (1977)			
seeds			0.81-1.19
Cowpea			
Atanasia N. et al (1978)			
seeds		0.41-0.56	
Cassman, K.G. et al (1981)			
seeds		0.22-0.34	
straw		0.19-0.52	
Eaglesham, A.R.J. et al (1982)			
seeds	3.36-4.50		
Eaglesham, A.R. et al (1977)			
seeds	3.33-??.?		
straw	2.20-??.?		
FAO (1977)			
seeds	3.39-4.90		
Johnson, W.A. (1975)			
seeds	3.97-4.18	0.62-0.65	1.39-1.51
Kuzayli, M.V. et al (1966)			
seeds	3.84-3.84	0.45-0.45	

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Marchand, G. et al (1971)			
seeds	2.93-4.61		
Meiners, C.R. et al (1976)			
seeds	3.90-3.98	0.51-0.53	0.80-0.88
Nnadi, L.A. et al (1976)			
seeds	4.05-4.54	0.59-0.61	1.56-1.56
straw	1.48-1.83	0.15-0.19	2.27-2.40
Peoples, M.B. et al (1985)			
seeds	2.52-3.47		
straw	0.64-2.71		
Reddy, N.V. et al (1983)			
seeds	3.56-3.67	0.53-0.54	1.72-1.82
straw	2.57-2.73	0.30-0.33	1.62-2.07
Sasseville, D.N. et al (1979)			
seeds	3.43-4.81		
straw	0.99-4.09		
Summerfield, R.J. (1980)			
seeds	3.60-3.85		
straw	1.23-1.73		
Summerfield, R.J. et al (1976)			
seeds	3.50-3.80		
straw	1.40-1.80		
Tella, A.F. et al (1980)			
seeds	3.04-4.11		
Verma, S.C. et al (1964)			
seeds	3.10-3.70	0.18-0.31	
Groundnut			
Aulakh, M.S. (1980)			
seeds		0.30-0.42	
Balasubramanian, V. (1980)			
seeds	3.44-4.02	0.32-0.43	0.86-0.86
straw	1.14-1.15	0.09-0.11	1.43-2.08
Bhan, S. (1977)			
seeds	5.12-6.34	0.54-0.59	
straw	1.24-1.68	0.09-0.10	
Bromfield, A.R. (1975)			
seeds		0.62-0.65	
straw		0.15-0.16	
Bromfield, A.R. (1973)			
seeds	3.91-?..?	0.35-?..?	
straw	1.36-?..?	0.11-?..?	
Bunting, A.H. (1960)			
seeds	5.15-?..?	0.33-?..?	0.70-?..?
straw	1.26-?..?	0.04-?..?	2.26-?..?
Chavan, L.S. (1983)			
seeds	4.52-4.79	0.41-0.47	0.63-0.65
straw	1.68-1.81	0.14-0.20	1.30-1.34
Chopra, S.L. (1982)			
seeds	2.87-4.03	0.06-0.10	1.07-1.48

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Daft, M.J. et al (1976)			
seeds	5.63-5.63	0.34-0.35	0.72-0.80
Habibur, R. et al (1973)			
seeds	3.46-8.02		
Lombin, G. et al (1986)			
seeds	3.52-4.53	0.30-0.47	0.80-0.88
straw	1.38-1.40	0.11-0.17	2.01-2.63
Pandle, D. et al (1971)			
seeds	3.84-4.37		
Ratner, E.I. et al (1979)			
seeds	2.70-4.99		
straw	1.00-1.69		
Singh, N. et al (1970)			
seeds	4.34-4.72		
Walker, M.E. et al (1976)			
seeds	3.67-4.49		
Walker, M.E. (1974)			
seeds	4.92-5.15	0.33-0.43	0.54-0.70
Wolnik, K.A. et al (1983)			
seeds		0.18-0.56	0.38-1.13
Yadav, R. (1970; pot experiment)			
seeds	4.22-4.57	0.12-0.16	1.55-1.79
Young, C.T. (1974)			
seeds	3.50-4.21		
Young, C.T. et al (1973)			
seeds	3.63-4.69		
Zalawadia N.M. (1983)			
seeds	2.66-2.84		0.92-1.23
straw	1.92-2.20		1.98-2.21

Lentils

Ahlawat, I.P.S. et al (1985)			
seeds	3.68-3.69		
straw	0.88-0.88		
Alahmad, M. (1981)			
seeds	4.06-4.29	0.38-0.43	1.30-1.34
straw	1.00-2.51	0.14-0.34	1.32-2.91
Benken, I. et al (1980)			
seeds	3.84-4.88		
Bhatty, R.S. et al (1976)			
seeds	4.18-4.85		
Duczek, L.J. et al (1981)			
seeds	2.70-4.18		
Hussein, M.A. (1984)			
seeds	4.31-4.42		
Kay, D.E. (1979)			
seeds	4.58-4.58	0.28-0.28	
Kuzayli, M.V. et al (1966)			
seeds	4.21-4.21	0.30-0.30	

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Meiners, C.R. et al (1976) seeds	4.72-4.92	0.45-0.59	0.83-0.89
Monti, L.M. (1983) seeds	4.00-4.69		
Singh, S. (1983) seeds	4.48-4.82		
Solh, M.S. et al (1981) seeds	3.30-5.34		
Summerfield, R.J. (1980) seeds	4.30-4.30	0.50-0.50	1.17-1.17
Wassami, N. et al (1978) seeds	3.58-5.62	0.09-0.21	0.54-0.93
Mungbean.			
Arona, S. (1972) seeds	3.15-3.89		
Aulakh, M.S. et al (1977) seeds		0.30-0.50	
straw		0.17-0.29	
Devarajan, R. et al (1980) seeds		0.06-0.11	
straw		0.02-0.03	
FAO (1977) seeds	3.33-5.30		
Gupta, J.P. et al (1979) seeds	3.23-4.16		
Kurdikeri, C.B. (1973) seeds	3.07-3.64		
Malhorta, V.V. et al (1976) seeds	3.36-4.80		
Moula, S.P. et al (1972) seeds	3.28-3.28	0.43-0.43	0.56-0.56
straw	0.84-0.84	0.18-0.18	1.05-1.05
Panwar, R.S. (1975) seeds	2.94-3.16		
Patil, D.S. et al (1982) seeds		0.30-0.38	
straw		0.14-0.18	
Singh, G. et al (1982) seeds	3.45-4.26	0.08-0.23	
straw	1.66-2.47	0.03-0.17	
Soni, G.L. (1975) seeds	3.84-4.47		
Srivastava, S.N.V. (1981) seeds	2.69-3.18	0.23-0.31	
Trung, B.C. (1985) seeds	3.34-3.71		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Trung, B.C. et al (1985)			
seeds	4.24-4.45		
straw	2.20-2.70		
Trung, B.C. et al (1983)			
seeds	2.40-4.64		
straw	1.53-3.94		
Trung, B.C. et al (1982)			
seeds	3.45-4.26		
straw	1.66-2.47		
Trung, B.C. et al (1982)			
seeds	4.47-4.47	0.21-0.21	0.90-0.90
straw	2.18-2.18	0.11-0.11	1.29-1.29
Venugopal, K. et al (1974)			
seeds	4.07-4.47	0.25-0.28	0.69-0.73
straw	3.66-4.79	0.38-0.46	1.04-1.78
Yadava, B.S. et al (1978)			
seeds	3.40-3.50		
straw	1.00-1.20		
Peas			
Acikgoz, E. et al (1985)			
seeds	3.94-5.09	0.46-0.61	0.75-1.06
straw	(3.40-3.80)	(0.34-0.35)	(1.34-1.54)
Adedipe, N.O. et al (1970)			
seeds	4.01-4.79	0.28-0.65	1.64-1.74
straw	1.43-2.58	0.06-0.21	1.57-2.29
Ali Khan, S.T. (1977)			
seeds	4.38-4.96		
Anderson, A.J. et al (1983)			
seeds	3.69-4.05		
straw	1.19-2.32		
Austin, R.B. (1966)			
seeds	3.32-4.25	0.20-0.62	1.31-2.48
Awasthi, C.P. et al (1978)			
seeds	3.64-4.06	0.26-0.33	
Beeson, K.C. (1941)			
seeds		0.30-0.74	
Brauning, T.H. (1981; pot experiment)			
seeds	3.94-6.22	0.38-0.95	
Brouwer, W. (1976)			
seeds	3.40-5.27	0.29-0.51	0.98-1.20
straw	(1.22-2.32)		
Chojnacki, A. et al (1971)			
seeds	2.46-3.82	0.42-0.56	0.61-1.19
Decleire, M. et al (1972)			
seeds		0.41-0.59	
FAO (1977)			
seeds	2.75-4.98		
Holl, F.B. et al (1980)			
seeds	3.31-4.32		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Hove, E.L. et al (1978)			
seeds	3.28-3.62		1.05-1.14
Jaiswal, S.P. et al (1975)			
seeds	1.67-4.80	0.43-0.71	
Lenka, D. et al (1972)			
seeds	3.79-3.99	0.36-0.40	
straw	1.06-1.07	0.06-0.07	
Mayr, H.H. (1969)			
straw		0.35-0.35	
McLean, L.A. et al (1974)			
seeds	3.17-4.75		
Meiners, C.R. et al (1976)			
seeds	3.80-3.96	0.28-0.42	1.05-1.10
Monti, L.M. (1983)			
seeds	2.48-6.35		
Peck, N.H. et al (1980)			
seeds		0.33-0.37	
Peck, N.H. (1978)			
seeds		0.35-0.39	1.10-1.20
straw		0.29-0.29	1.10-1.10
Sosuliski F.W. et al (1974)			
straw	3.98-4.96		
Trevino, I.C. et al (1975)			
seeds	4.56-8.30		
straw	0.77-6.70		
Soybeans			
Bhangoo, M.S. et al (1972)			
seeds	6.09-6.69	0.57-0.66	2.00-2.15
Cassman, K.G. et al (1981)			
seeds		0.35-0.65	
straw		0.21-0.54	
Chevalier, H. (1976)			
seeds	6.76-7.21	0.78-0.79	2.12-2.26
straw	0.94-1.18	0.12-0.14	0.58-1.02
Coupron, C. et al (1975)			
seeds	5.76-6.04	0.63-0.66	1.68-1.83
straw	2.02-2.74	0.27-0.42	1.60-1.67
Deibert, R.J. (1979)			
seeds	4.61-6.48		
Dubetz, S. et al (1983)			
seeds	5.26-6.35		
Fellmann, K. (1985)			
seeds	4.71-6.49		
straw	0.83-1.19		
Ganry, F. (1982)			
seeds	6.30-6.47	0.39-0.50	
straw	0.74-1.04	0.03-0.07	
Gaydon, E.M. et al (1983)			
seeds	5.87-7.41		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Ham, G.E. et al (1978)			
seeds	6.46-6.47	0.66-0.94	
straw	0.90-0.96	0.25-0.31	
Ham, G.E. et al (1975)			
seeds	4.99-6.32		
straw	0.40-1.16		
Ham, G.E. et al (1973)			
seeds	6.10-6.66		
Ham, G.E. et al (1971)			
seeds	6.24-6.67		
Hanway, J.J. (1971)			
seeds	4.94-7.34	0.46-0.86	1.69-2.12
straw	(1.63-1.75)	(0.10-0.12)	(0.74-0.94)
Harper, J.E. (1971)			
seeds	6.08-6.24		
Hoque, M.S. et al (1984; pot experiment)			
seeds		0.43-0.62	
straw		0.10-0.23	
Johnson, J.W. et al (1975)			
seeds	5.84-5.88		
straw	1.67-1.74		
Kapoor, A.C. et al (1977)			
seeds	6.28-7.13	0.56-0.98	
Konno, S. (1969)			
seeds	6.99-7.62	0.94-0.96	2.80-2.80
straw	0.66-0.69	0.71-0.99	2.83-3.51
Mahajan, J.P. et al (1982)			
seeds		0.62-0.71	
straw		0.04-0.10	
Mishra, R. et al (1982)			
seeds	5.84-7.39	0.48-0.73	
Piere, C. (1983)			
seeds	6.13-6.74	0.55-0.61	1.84-2.32
straw	0.81-1.03	0.09-0.11	0.85-1.03
Rahman, H. et al (1973)			
seeds	6.05-6.99		
Schenker, N.C. (1973)			
seeds	5.18-6.48		
Singh, N.P. (1973)			
seeds		0.52-0.76	
Terman, G.L. (1977; pot experiment)			
seeds	5.68-6.91	0.35-0.55	1.42-1.78
Wahua, T.A.T. et al (1978)			
seeds	6.89-8.28		
straw	2.68-3.45		
Weber, C.R. (1966)			
seeds	4.48-6.35		
Wolnik, K.A. et al (1983)			
seeds		0.29-0.79	1.41-2.11

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Cassava			
Fox, R.H. (1975)			
tubers	0.48-0.65		
tops	1.17-1.54		
Gopalakrishna, K.P. et al (1978)			
tubers	0.31-0.38		
Howeler, R.H. et al (1983)			
tubers	1.05-1.05	0.12-0.12	0.79-0.79
tops	1.95-1.95	0.18-0.18	0.90-0.90
Howeler, R.H. (1980)			
tubers		0.09-0.60	
tops		0.07-0.50	
Howeler, R.H. (1978)			
tubers	0.27-0.93	0.11-0.12	0.34-0.98
Kanapathy, K. (1974)			
tubers	0.27-0.28	0.11-0.13	0.39-0.68
tops	0.99-1.14	0.37-0.59	0.76-1.48
Kumar, B.M. et al (1971)			
tubers			0.42-1.41
tops			0.71-1.69
Ludecke, H. et al (1969)			
tubers	0.25-0.50	0.09-0.13	0.50-0.83
Malavolta, E. et al (1955)			
tubers	0.25-0.82		
Mason, S.C. et al (1986)			
tubers	0.50-0.72	0.09-0.10	0.64-0.72
tops	1.17-1.20	0.11-0.12	0.63-0.65
Muthuswamy, P. et al (1975)			
tubers	0.16-0.55	0.08-0.24	0.77-1.33
Nair, P.G. et al (1980)			
tubers			0.74-1.10
tops			1.00-1.20
Nnongi, A.G.N. et al (1977)			
tubers	0.43-0.71		0.30-0.80
Obigbesan, G.O. (1977)			
tubers	0.33-0.39	0.09-0.11	0.96-1.19
Oelsigle, D.D. (1975)			
tubers	0.82-0.82	0.10-0.10	0.59-0.59
tops	1.69-1.69	0.18-0.18	0.77-0.77
Okeke, J.E. et al (1982)			
tubers	0.50-0.80	0.02-0.05	1.00-1.50
Rajendran, N et al (1976)			
tubers			0.55-1.48
tops			1.29-2.26
Rodriguez-Soga, E.J. et al (1976)			
tubers	0.20-0.28		
Solorzano, N.V. et al (1976)			
tubers		0.12-0.14	1.21-1.44
tops		0.20-0.20	1.64-1.68

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Spittstoesser, W.E. (1977)			
tubers	0.24-0.83		
Teles, F.F.F. et al (1985)			
tubers	0.22-0.75		
Vyayan, M.R. et al (1969)			
tubers	0.23-0.38		
Zaag, P. van der et al (1979)			
tubers		0.06-0.10	
Onions			
Alers, S. et al (1979)			
leaves	2.30-2.84	0.15-0.24	2.43-4.60
Asif, M.I. et al (1976)			
bulbs		0.36-0.37	
leaves		0.46-0.56	
Beeson, K.C. (1941)			
bulbs		0.17-0.74	
Bishop, R.F. et al (1972)			
bulbs	0.65-1.39	0.15-0.41	0.74-1.73
leaves	1.88-3.03	0.16-0.54	1.09-4.39
extreme values leaf	1.62-3.46	0.12-0.61	0.55-5.11
Hamilton, H.A. et al (1975)			
bulbs	1.81-1.81	0.41-0.41	1.57-1.57
leaves	1.37-1.37	0.23-0.23	2.41-2.41
Mahmoud, S.H. et al (1978)			
leaves	2.32-3.24	0.16-0.22	2.58-3.06
Malachowski, A. (1975)			
leaves		0.30-0.37	3.00-4.00
Mathur, S.P. et al (1983)			
bulbs	1.56-3.58	0.47-1.04	0.68-1.32
leaves	2.56-3.48	0.26-1.58	1.13-2.69
Mayer, H.H. (1969)			
leaves		0.18-0.18	
Pankov, V.V. (1985/1986)			
leaves	?.??-3.40	0.27-0.33	2.00-2.50
Patterson, D.R. et al (1960)			
bulbs	0.89-1.35	0.19-0.38	1.42-1.84
Rankov, V. et al (1980)			
bulbs	1.12-1.43	0.67-0.87	1.23-1.37
Rennie, D.A. et al (1975)			
bulbs	1.44-1.75	0.18-0.27	
leaves	1.75-2.98	0.16-0.25	
Sinry, A.R. et al (1974)			
bulbs	1.17-2.63	1.09-1.41	0.84-1.28
leaves	0.97-1.98	0.46-0.75	0.79-1.68
Smittle, D.A. (1984)			
bulbs	1.09-1.63		
leaves	2.32-2.86		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Potato			
Bacigalupo, A. (1972) tubers	0.85-2.46		
Beeson, K.C. (1941) tubers		0.11-0.49	
Bolton, J. (1976) tubers		0.11-0.18	1.15-2.16
Bucher, R. et al (1982) tubers			1.89-2.08
tops			1.97-2.41
Burton, G.W. (1966) tubers	1.16-1.95	0.12-0.61	1.39-2.83
Carpenter, P.N. (1975) tubers			1.33-1.33
tops			3.64-3.64
Carpenter, P.N. (1963) tubers	1.56-1.84	0.09-0.32	1.32-2.76
tops	1.57-3.18	0.19-0.24	2.66-5.33
Dainty, J. et al (1959) tubers		0.28-0.89	
tops		0.28-1.40	
Dunn, L.E. et al (1949) tubers		0.18-0.24	
tops		0.17-0.22	
Greenwood, D.J. et al (1980) tubers		0.23-0.25	
Gupta, A. et al (1976) tubers	0.81-1.74		
Hagemann, O. (1961) tubers		0.16-0.21	1.40-2.34
Ifenkwe, O.P. et al (1983) tubers			2.18-2.54
Johnston, A.E. et al (1976) tubers		0.14-0.34	
Kapoor, A.C. (1983) tubers	1.20-1.33		
Krentos, V.D. et al (1979) tubers	1.13-1.41	0.16-0.22	2.31-2.52
Liegel, E.A. et al (1976) tubers	0.93-1.52		
Lorenz, O.A. (1947) tops	2.87-3.00		
Lorenz, O.A. (1944) tubers	0.87-1.76	0.24-0.33	1.98-2.33
Loue, A. (1975) tubers	1.20-1.80	0.15-0.30	1.20-2.50
Luitjens, E.J. et al (1979) tubers	1.60-1.73	0.12-0.18	
tops	2.37-2.77	0.08-0.16	

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Mager, H.H. (1969)			
tubers		0.24-0.32	
tops		0.19-0.27	
Mathur, S.P. et al (1983)			
tubers	1.30-1.48	0.37-0.46	1.95-2.18
tops	2.54-5.41	0.55-1.22	1.33-2.63
Nankar, J.T. et al (1982)			
tubers	1.27-1.42	0.16-0.17	1.56-1.73
tops	2.05-2.29	0.19-0.20	3.49-3.79
Nelson, W.L. et al (1947)			
tubers		0.16-0.24	
tops		0.13-0.19	
Saffigna, P.G. et al (1977)			
tubers	1.40-1.50		
tops	0.80-2.10		
Sharma, R.C. et al (1980)			
tubers		0.15-0.25	1.33-4.59
Soltanpour, P.N. (1973)			
tubers	1.39-1.39	0.20-0.20	1.30-1.30
tops	2.17-2.17	0.14-0.14	1.97-1.97
Temme, J. (1970)			
tubers	0.72-2.07	0.11-0.29	0.92-2.54
tops	(1.81-?..?)	(0.15-?..?)	(0.37-?..?)
Tserling, V.V. (1975)			
tops	4.00-?..?	0.26-?..?	2.91-?..?
Veen, L van der (1984)			
tubers	1.27-1.84	0.18-0.26	1.85-2.33
Vigue, J. et al (1975)			
tubers	1.21-3.26		
Ward, G.M. (1959)			
tubers			1.10-2.00
Wolnik, K.A. et al (1983)			
tubers		0.21-0.34	1.98-2.12
Sweet Potato			
Bautista, A.M. et al (1976)			
tubers	0.37-0.69		
tops	1.62-2.68		
Beeson, K.C. (1941)			
tubers		0.06-0.22	
Bouwkamp, J.C. (1982)			
tubers	0.28-1.89		
Bradbury J.H. et al (1984)			
tubers	0.31-1.06		
Constatin, R.J. et al (1984)			
tubers	0.68-1.54		
Constatin, R.J. et al (1974)			
tubers	0.86-1.38		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Fabro, L.E. et al (1976)			
tubers	0.80-0.80	0.21-0.21	1.74-1.74
tops	2.90-2.90	0.41-0.41	5.33-5.33
Hammett, L.K. et al (1984)			
tubers	1.10-1.36	0.20-0.21	1.99-2.32
Knavel, D.E. et al (1969)			
tubers			1.20-1.20
Ludecke, H. et al (1969)			
tubers	0.40-0.50	0.07-0.07	0.58-0.66
Mandal, R.C. et al (1971)			
tubers	0.26-0.47		
Nijhof, K. (1985)			
tops	1.71-2.63	0.27-0.59	1.25-3.90
Onwueme, I.C. (1978)			
tubers	0.30-0.47		
Purcell, A.E. et al (1982)			
tubers	0.80-1.54		
Purcell, A.E. et al (1972)			
tubers	0.28-1.46		
Scott, L.E. (1950)			
tubers			2.56-3.89
tops			2.32-3.17
Scott, L.E. et al (1974)			
tubers	0.54-0.56	0.18-0.20	1.66-1.74
tops	1.97-2.25	0.24-0.29	2.91-3.39
Scott, L.E. et al (1952)			
tubers	1.01-1.01	0.22-0.22	1.60-1.60
tops	1.58-1.58	0.19-0.19	2.84-2.84
Sharfuddin, A.F.M. et al (1984)			
tubers	0.59-0.72		
Singh, K.D. et al (1976)			
tubers	0.42-0.64		
tops	2.02-3.95		
Tsuno, Y. (1978)			
tops	1.53-?..?		
Uriyo, A.P. (1974)			
tubers		0.38-0.43	1.70-1.83
Yoshida, T. et al (1969)			
tubers			0.54-0.80
tops			1.61-1.61
Cotton			
Alyari, H. (1969)			
seeds	2.89-3.31	0.38-0.57	1.04-1.17
lint	0.12-0.27	0.02-0.04	0.29-0.61
Basinski, J.J. et al (1971)			
bolls	1.40-2.50		
straw	1.01-2.26		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Basset, D.M. et al (1970)			
bolls	2.00-2.00	0.33-0.33	1.67-1.67
burs	0.90-0.90	0.17-0.17	4.11-4.11
seeds	3.98-3.98	0.56-0.62	1.03-1.03
straw	1.80-1.80	0.16-0.16	1.55-1.55
Beeson, K.C. (1941)			
burs		0.07-0.21	
seeds		0.48-1.79	
lint		0.03-0.12	
Bennett, O.L. et al (1965)			
bolls			1.69-2.63
Bhatt, J.G. et al (1979/1976)			
bolls	1.55-1.81	0.24-0.29	1.36-1.58
straw	1.25-1.25	0.08-0.18	1.09-1.78
Bhatt, J.G. et al (1974)			
bolls	1.74-2.35	0.52-0.85	
seeds	3.99-7.73	1.24-2.55	4.12-8.01
straw	1.43-2.00	0.20-0.85	
Bhatt, J.G. et al (1971)			
bolls	1.75-1.98	0.64-0.73	1.20-1.20
burs	0.83-1.00	0.23-0.31	1.09-1.10
seeds	3.40-4.12	1.24-1.57	3.01-3.43
lint	0.24-0.28	0.14-0.15	0.26-0.31
straw	1.02-1.37	0.31-0.41	1.31-1.65
Christidis, B.G. (1969)			
bolls	1.90-1.90	0.34-0.34	1.21-1.21
burs	1.07-1.07	0.21-0.21	2.21-2.21
seeds	3.13-3.13	0.55-0.55	0.97-0.97
lint	0.34-0.34	0.04-0.04	0.38-0.38
straw	2.27-2.27	0.38-0.38	1.32-1.32
Deat, M. et al (1974)			
straw	0.58-0.58	0.04-0.04	1.10-1.10
Eaton, F.M. et al (1969)			
bolls	1.09-1.09	0.34-0.34	0.70-0.70
straw	1.76-1.76	0.16-0.16	1.67-1.67
Doss, B.D. et al (1969)			
bolls	1.43-2.10		
straw	0.82-2.24		
El Kadi, M. et al (1977)			
straw		0.17-0.22	
Havely, J. (1976)			
bolls	1.82-1.82	0.37-0.37	1.70-1.76
burs	0.53-0.55	0.13-0.15	2.75-2.80
seeds	3.65-3.96	0.73-0.76	1.34-1.35
lint	0.21-0.23	0.03-0.05	0.44-0.53
straw	1.90-2.07	0.36-0.40	1.03-1.19
Hearn, A.B. (1981)			
seeds	3.02-3.84		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Heinemann, C. (1969)			
bolls	1.99-2.45	0.40-0.41	0.85-1.42
burs	1.08-1.83	0.21-0.34	0.96-2.21
seeds	3.13-3.54	0.55-0.61	0.94-0.97
lint	0.18-0.34	0.04-0.04	0.38-0.49
straw	1.39-1.90	0.15-0.34	0.80-1.22
Joham, H.E. (1955; pot experiment)			
bolls			0.77-1.50
straw			0.49-1.46
Jones, J.W. et al (1974)			
bolls	1.80-?..?		
Kamprath, E.J. et al (1968)			
bolls			1.00-1.00
straw			2.20-2.20
Kapp, L.C. et al (1953)			
bolls		0.17-0.21	
Khare, A.K. et al (1970)			
bolls	2.01-2.20		
straw	1.52-1.74		
Leffler, H.R. et al (1976)			
bolls	2.22-2.22	0.51-0.51	1.91-1.91
burs	0.67-0.67	0.28-0.28	5.50-5.50
seeds	5.44-5.44	1.17-1.17	1.29-1.29
lint	trace	0.02-0.02	0.65-0.65
Malik, C.V.S. et al (1984)			
bolls	1.70-2.00		
straw	0.89-1.14		
Meek, B.D. et al (1980)			
straw	1.10-1.46	0.10-0.13	1.63-2.20
Morrison, F.B. (1951)			
bolls	1.40-?..?		
Oosterhuis, D.M. (1983)			
bolls	2.93-5.12		
straw	0.94-1.11		
Salami, P. (1978)			
seeds	3.25-4.10	0.27-0.78	0.82-1.15
Thompson, A.C. et al (1976)			
bolls	1.40-2.48		
 Jute			
Dargan, K.S.S. (1969)			
stems	0.25-0.63	0.12-0.16	0.79-1.06
leaves	(2.85-3.60)	(0.37-0.52)	(2.16-2.57)
Dempsey, J.M. et al (1971)			
stems	0.97-0.97	0.16-0.16	1.77-1.77
leaves	3.01-3.01	0.48-0.48	3.03-3.03
Ghosh, T. et al (1966)			
stems			2.50-?..?
leaves			2.50-?..?

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Jute Agricultural Research Institute (1975)			
stems	0.39-0.82	0.18-0.38	2.36-2.50
leaves	2.00-3.12	0.27-0.27	2.68-2.77
Khan, D.H. et al (1961)			
leaves		0.13-?..??	0.53-?..??
Mandal, A.K. et al (1970)			
stems	0.28-0.33	0.11-0.16	0.94-1.29
leaves	3.04-3.77	0.36-0.44	2.41-2.41
Pain, S.K. (1969)			
stems	1.05-1.15		
leaves	5.30-5.40		
Kenaf			
Adamson, W.C. et al (1979)			
stems	0.30-0.48	0.10-0.19	1.01-2.59
Andrew, C.S. et al (1980)			
stems	0.29-0.29	0.16-0.16	1.92-1.92
Clark, T.F. (1969)			
stems	0.80-1.60		0.80-1.00
leaves	3.10-4.70		0.80-1.20
Dempsey, J.M. et al (1971)			
stems	0.83-0.83	0.22-0.22	1.08-1.08
leaves	2.16-2.16	0.24-0.24	0.96-0.96
Hansen, R.W. (1981)			
stems	0.22-0.22	0.07-0.07	1.46-1.46
leaves	1.07-1.07	0.22-0.22	1.10-1.10
Killinger, G.B. (1969)			
leaves	3.87-4.61		
Knowles, R.E. (1974)			
stems	1.69-1.69		
leaves	2.83-2.83		
Mandal, A.K. et al (1970)			
stems	0.24-0.24	0.19-0.19	1.04-1.04
leaves	2.88-2.88	0.32-0.32	1.01-1.01
Sinka, A.K. et al (1980)			
stems	0.35-0.38	0.30-0.30	2.13-2.24
leaves	2.35-2.49	0.31-0.31	2.25-2.25
Wood, I.M. (1978; crop 240 days old)			
stems	0.30-0.30	0.06-0.06	0.93-0.93
leaves	0.96-0.96	0.13-0.13	1.44-1.44
Rapeseed			
Anderson G. et al (1958)			
seeds	3.94-3.94	0.69-0.69	1.76-1.76
Aulakh, M.S. et al (1978)			
seeds			0.35-0.96
straw			1.03-1.59

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Chojnacki, A. et al (1971)			
seeds	3.22-3.98	0.65-0.85	0.62-1.09
straw	(0.54-0.70)	(0.05-0.12)	(1.49-1.86)
Diepenbrock, W. (1979)			
seeds	3.74-4.21		
Diepenbrock, W. et al (1978)			
seeds	3.96-4.61		
Grami, R. et al (1977)			
seeds	4.11-4.85		
straw	0.51-0.95		
Goralski, J. et al (1970)			
seeds	3.44-3.66		
straw	0.66-0.74		
Holmes, M.R.J. et al (1979)			
seeds	3.28-3.92		
Holmes, M.R.J. et al (1978)			
seeds	3.57-3.68	0.68-0.79	0.70-0.70
Holmes, M.R.J. et al (1977)			
seeds		0.73-0.75	0.67-0.70
King, J.R. et al (1977)			
seeds	1.76-6.72		
Leroy, M.A. (1973)			
seeds	3.40-3.40	0.72-0.72	0.88-0.88
straw	0.59-0.59	0.10-0.10	1.62-1.62
Mingeau, M. (1975)			
seeds	2.83-3.29		
Nehring, K. et al (1945)			
seeds	3.40-3.40		
straw	0.53-0.53		
Nutall, W.F. (1973)			
seeds	4.99-6.14		
Osinka, H. (1980)			
seeds	2.00-7.45		
Racz, G.J. et al (1965)			
seeds	3.40-4.30	0.61-0.80	
straw	0.80-1.90	0.08-0.14	
Rood, S.B. et al (1984)			
seeds	4.07-4.79		
straw	0.69-0.69		
Schuster, W. (1980)			
seeds	3.68-4.96		
Stabbetorp, H. (1973)			
seeds		0.81-0.83	0.67-0.68
straw		0.11-0.20	0.95-1.19
Szukalski, H. (1985)			
seeds		0.31-0.96	
Thomas, T.M. (1985)			
seeds	3.76-4.04		
Toniolo, L. et al (1985)			
seeds	2.64-3.51		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Zabec, S. (1977) seeds	3.18-3.82	0.79-0.80	0.76-0.88
Sesame			
Balascones, L. et al (1961) capsules	1.62-1.62	0.24-0.24	1.64-1.64
straw	0.92-0.92	0.41-0.41	1.22-1.22
Reddy, B.K. et al (1979) capsules	1.97-2.13	0.31-0.35	1.10-1.28
straw		0.26-0.27	1.17-1.25
Sinry, A.R. et al (1979) straw		0.29-0.82	1.61-2.42
Santos, R.A. (1986) capsules			1.86-1.86
Sunflower			
Ashwani, K. et al (1978) seeds	3.46-4.19		
Blamey, F.P.C. et al (1981) seeds	1.79-2.93		
Chabra, R. et al (1979) seeds			0.78-0.84
Coic, Y. et al (1972) seeds	3.52-6.06		
Gashon, L. (1972) seeds	3.13-3.13	0.53-0.55	0.73-0.82
straw	0.91-0.98	0.10-0.10	4.37-4.70
Hocking, P.J. et al (1983) seeds	3.55-4.25		
straw	0.87-1.37		
Hocking, P.J. et al (1983) seeds		0.43-0.57	0.76-0.81
straw		0.07-0.12	1.93-1.93
Hussein, M.A. et al (1980) seeds	3.60-3.79		
Kabra, G.S. et al (1980) seeds	2.47-3.30	0.44-0.53	0.85-1.03
straw	0.78-1.19	0.28-0.40	0.87-1.12
Kandil, A.A. (1984) seeds	1.82-3.00		
Kathiresan, M. et al (1980) seeds	2.96-4.50		
Marinescu, R. (1980) seeds	2.24-4.13		
Mathers, A.C. et al (1982) seeds	2.40-3.50	0.60-0.60	
straw	0.72-1.80	0.09-0.29	

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Osborne, G.J. et al (1978)			
seeds		0.35-0.67	
Rahman, H. et al (1973)			
seeds	2.38-3.54		
Robinson, R.G. (1975)			
seeds	2.64-3.05	0.49-0.65	0.64-0.72
Robinson, R.G. (1973)			
seeds	2.58-2.58	0.39-0.39	0.59-0.59
straw	1.03-1.03	0.08-0.08	1.51-1.51
extreme values seed	2.54-3.76	0.37-0.81	0.55-0.92
Roy, D.N. et al (1974)			
seeds	2.64-3.28		
Samui, R.C. et al (1980)			
seeds	3.36-4.75		2.44-3.73
straw	1.25-1.49		1.00-1.22
Singh, P.P. et al (1975)			
seeds	2.85-3.10		
Smiths, G.A. et al (1978)			
seeds	3.17-3.78		
Steer, B.T. et al (1986)			
seeds	1.78-2.70		
straw	0.79-2.37		
Steer, B.T. et al (1985)			
seeds	1.98-3.63		
straw	0.39-1.14		
Steer, B.T. et al (1984)			
seeds	2.59-3.18	0.77-1.02	
Sukhareva, O.N. (1976)			
seeds		1.64-1.87	
Vrebalov, T. (1977)			
seeds	2.60-2.60	0.57-0.57	0.92-0.92
Sugarcane			
Afria, B.S. et al (1980)			
leaves	0.55-0.77		
Ayres, A. (1930)			
stems	0.06-0.17	0.11-0.15	0.88-1.44
Baver, L.D. (1969)			
stems	0.08-0.23		
Beeson, K.C. (1941)			
leaves		0.09-0.22	
Bordon, J. (1948)			
leaves	0.89-?.		
Cardenas, A.C. et al (1978)			
leaves	1.42-?.		
Clements, H.F. (1977)			
stems	0.12-0.12	0.04-0.08	0.34-0.95
leaves	0.80-0.80	0.10-0.13	0.69-1.48
Clements, H.F. et al (1970)			
leaves	1.62-2.59		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Clements, H.F. (1947) leaves			0.17-5.10
Cooke, G.W. (1972) leaves	1.48-1.70		
Golden, L.E. et al (1977) leaves	1.06-?..??	0.12-?..??	0.48-?..??
Golden, L.E. et al (1975) stems	0.33-0.41	0.06-0.11	0.36-0.54
leaves	0.74-0.87	0.10-0.15	1.06-1.38
Golden, L.E. et al (1963) stems	0.27-0.27	0.07-0.07	0.41-0.41
leaves	0.79-0.79	0.10-0.10	0.80-0.80
Halliday, D.J. (1956) stems	0.13-0.13	0.15-0.15	0.39-0.39
leaves	0.81-0.81	0.24-0.24	1.74-1.74
Hartt, C.E. (1972) leaves		0.12-0.25	
Hartt, C.E. (1958) stems		0.04-0.05	
Hartt, C.E. (1934) stems			0.28-1.50
leaves			(0.36-2.48)
Hes, J.W. (1949) stems	0.44-0.44		
Holford, I.C.R. (1968) leaves	1.40-?..??	0.13-?..??	0.90-?..??
Houwelingen, P. van (1905) stems	0.14-0.27	0.08-0.12	0.56-1.10
leaves	0.36-0.43	0.08-0.15	0.66-1.19
Humbert, R.P. (1968) stems	0.12-1.48		
leaves	(1.22-1.56)		
Humbert, R.P. (1955) stems			0.14-1.30
leaves	1.31-1.70		(1.00-1.90)
Husz, G.S. (1972) leaves	1.00-?..??	0.10-0.22	0.83-1.66
Manuelpillai, R.G. (1975) stems	1.52-?..??	0.20-?..??	1.68-?..??
Meyer, J.H. (1982) leaves	1.24-1.74	0.11-?..??	0.90-?..??
Moberly, P.K. (1983) leaves			1.05-?..??
Obatolu, C.R. et al (1985) stems		0.16-0.16	0.76-0.85
leaves		0.16-0.38	1.21-2.28
Prasad, M. (1976) leaves	1.28-?..??	0.16-?..??	1.10-?..??
Prasad, M. (1976) leaves	1.00-?..??		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Rao, N.V.R. et al (1956)			
stems	0.32-0.49		
Ruschel, A.P. et al (1978)			
stems	0.12-0.19		
leaves	0.34-0.54		
Schmell, W.R. et al (1964)			
leaves	1.00-?..?		0.30-?..?
Singh, B. et al (1969)			
leaves	1.10-1.24		
Stanford, G. et al (1964)			
stems	0.16-0.16		
Stewart, M.J. (1969)			
leaves			0.75-?..?
Sumner, M.E. (1979)			
leaves	1.56-?..?	0.16-?..?	1.10-?..?
Yoon, C.N. (1972)			
stems	0.29-0.29	0.04-0.04	0.51-0.51
leaves	1.22-1.22	0.18-0.18	1.58-1.58
Tobacco			
Atkinson, W.O. et al (1977)			
leaves	4.56-4.56	0.23-0.23	3.40-3.40
stems	2.43-2.43	0.16-0.16	2.88-2.88
Bertinuson, T.A. et al (1970)			
leaves	3.84-4.00	0.14-0.19	3.53-5.69
Chaplin, J.F. (1976)			
leaves	1.76-2.47		
Dierendonck (1959)			
leaves	2.07-2.76	0.27-0.30	3.64-3.64
stems	1.80-1.80	0.27-0.27	2.62-3.26
Eakin, J.H. (1972)			
leaves	3.77-3.77	0.36-0.36	5.00-5.00
Elliot, J.M. et al (1985)			
leaves		0.18-0.39	1.41-2.97
Elliot, J.M. et al (1983)			
leaves		0.19-0.39	1.05-3.12
Elliot, J.M. (1977)			
leaves		0.33-0.61	2.25-4.13
Elliot, J.M. (1976)			
leaves		0.16-0.33	1.86-3.74
Elliot, J.M. (1975)			
leaves	1.67-2.84		
Fuqua, B.D. et al (1976)			
leaves	3.07-4.14		2.54-3.39
Hamilton, J.L. et al (1982)			
leaves	3.53-5.20		
Hutcheson, T.B. et al (1959)			
leaves	1.51-1.77		0.94-2.14

Reference Crop crop part	N min-max %	P min-max %	K min-max %
Kroontje, W. et al (1972)			
leaves	4.72-4.77		
stems	2.35-2.41		
Kumar, P.A. (1982)			
leaves	1.02-3.40		
Lagatu, H. et al (1935)			
leaves			2.79-5.29
Lamarre, M. (1983)			
leaves	2.11-3.58		
Legget, J.E. et al (1977)			
leaves	4.32-4.38		0.57-3.19
stems	3.33-3.51		1.21-2.95
Linser, H. et al (1969)			
leaves	1.58-3.65	0.20-0.26	0.67-5.82
stems	0.78-2.52	0.16-0.39	1.12-4.14
Mayer, H.H. (1969)			
leaves		0.12-0.50	
McEvoy, E.T. (1955)			
leaves			0.49-3.00
Morgan, M.F. et al (1935)			
leaves	2.80-2.95		
stems	1.33-1.63		
Necesito, A.C. et al (1978)			
leaves	0.88-1.67		
Nelson, W.L. et al (1948)			
leaves		0.24-0.29	
stems		0.20-0.28	
Nelson, W.L. et al (1947)			
leaves		0.25-?..?	
stems		0.20-?..?	
Oyonowski, J.W. et al (1976)			
leaves	1.27-2.68	0.24-0.58	2.18-3.87
Peedin, G.F. et al (1977)			
leaves	1.63-2.94		1.30-4.60
Rhoads, F.M. (1972)			
leaves	3.46-3.84		1.98-5.16
Rhoads, F.M. (1972)			
leaves	3.98-?..?	0.27-?..?	4.56-?..?
Rhoads, F.M. (1972)			
leaves		0.16-0.47	
stems		0.12-0.35	
Rhoads, F.M. (1971)			
leaves		0.17-0.26	2.58-6.60
Schmid, K. (1951)			
leaves	2.50-2.50	0.30-0.30	5.00-5.00
Scott, W.A. et al (1975)			
leaves	3.04-4.77	0.22-0.40	2.19-5.41
Sievert, R. (1978)			
leaves	3.73-4.27		
Sims, J.L. et al (1975)			
stems	3.83-4.72		

Reference Crop crop part	N min-max %	P min-max %	K min-max %
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Srivastava, R.P. et al (1983)			
leaves	3.97-3.97	0.24-0.24	4.18-4.18
stems	1.35-1.35	0.23-0.23	2.88-2.88
Ward, D.K. et al (1973)			
leaves	0.93-1.12	0.44-0.68	
Zartman, R.E. et al (1976)			
leaves	2.54-3.76		
stems	1.06-2.29		
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