Foresight Analysis for Grain Legumes and **Dryland Cereals (GLDC)**

This report is commissioned by ICRISAT to accompany the proposal on
CGIAR Research Program on
Grain Legumes and Dryland Cereals Agri-food Systems

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Foresight Analysis for Grain Legumes and Dryland Cereals (GLDC)

Results from the latest version of the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT) developed by IFPRI have been used to describe the future outlook for the CRP GLDC crops[1] and regions in terms of the likely changes in their cropped production and consumption in the medium and long terms.

At IMPACT's core is a global, partial equilibrium, multi-market, agriculture sector model. Global, climate-sensitive hydrology and water use models are linked to IMPACT (Robinson et al. 2015). The DSSAT crop modelling suite (Hoogenboom et al. 2015) is also joined at the front end to directly estimate yields of crops under varying management and climate change scenarios from global climate models. Food supply is determined for 320 sub-national or national geographic units [Food Production Units (FPUs)] delineated according to intersections of administrative units (chiefly countries) with major river basins. Projection results can be either reported by FPU or by country. Irrigated and rainfed crop yields and area changes or livestock numbers and yields include exogenous sources, such as those from projected public and private sector investment trends as well as impacts from climate change and agricultural (vs urban) areas growth, and endogenous sources (mostly driven by elasticities), such as farmer responses to changing prices.

The model simulates 62 agricultural commodities (crops, livestock, and several secondary agricultural products), including explicit modelling of nearly all CGIAR mandate crops. Water availability is modelled at the grid level and aggregated to the FPU level, with water demand determined through crop/livestock life cycles, cropping patterns, and competition with non-agricultural sectors at FPU levels. Agricultural land use and land use change are modelled at the FPU level based on historical trends and expert opinion on responses to agricultural prices. Commodity markets are cleared annually out to 2050 while the agronomic and water models operate at a monthly time step incorporating standardized crop calendars. Food demands are simulated for 159 countries and regions based on changes in income, population, and prices (Robinson et al. 2015).

Results are presented here for a baseline scenario that assumes "middle-of-the-road" growth in population and income (according to the IPCC's Shared Socioeconomic Pathway 2) and with no climate change.

Aggregate supply and demand projections of GLDC crops in LIFDC[2] ('000 MT)

The aggregate supply and demand projections for the eight GLDC crops (sorghum, millets, groundnut, chickpea, cowpea, lentil, pigeonpea and soybean) in the Low Income Food Deficit Countries (LIFDCs) follow an increasing trend based on projected growth in population, income, and productivity (as suggested by the SSP2 Scenario). However, the aggregate supply of grain legumes in the LIFDC countries remains lower than the demand. Furthermore, the supply-demand gaps for these countries is projected to widen in the long term without climate change. Under climate change scenario (HDGEM)[3], the future production of GLDC crops is lower than under a no climate change scenario (Figure 1). The production of GLDC crops will drop by 3% in 2025 and by 5% by 2050 relative to baseline in LIFDCs. GLDC crops are sensitive to climate change and their production will decline further in the future with the current level of technologies.

To ensure food and nutritional security in these countries, the supply side constraints of the GLDC crops will certainly need to be addressed through development and diffusion of appropriate technologies for different production environments in the LIFDC countries.

[1] GLDC crops – Sorghum, millets, groundnut, chickpea, pigeonpea, cowpea, lentils and soybean.

[2] For more details on LIFDC in 2017, please refer to http://www.fao.org/countryprofiles/lifdc.asp

[3] NoCC assumes a constant 2005 climate; CC reflects climate change using RCP 8.5 and the Hadley Climate Model. For details on the climate change scenario (HDGEM), refer to Rosegrant et al. 2017.

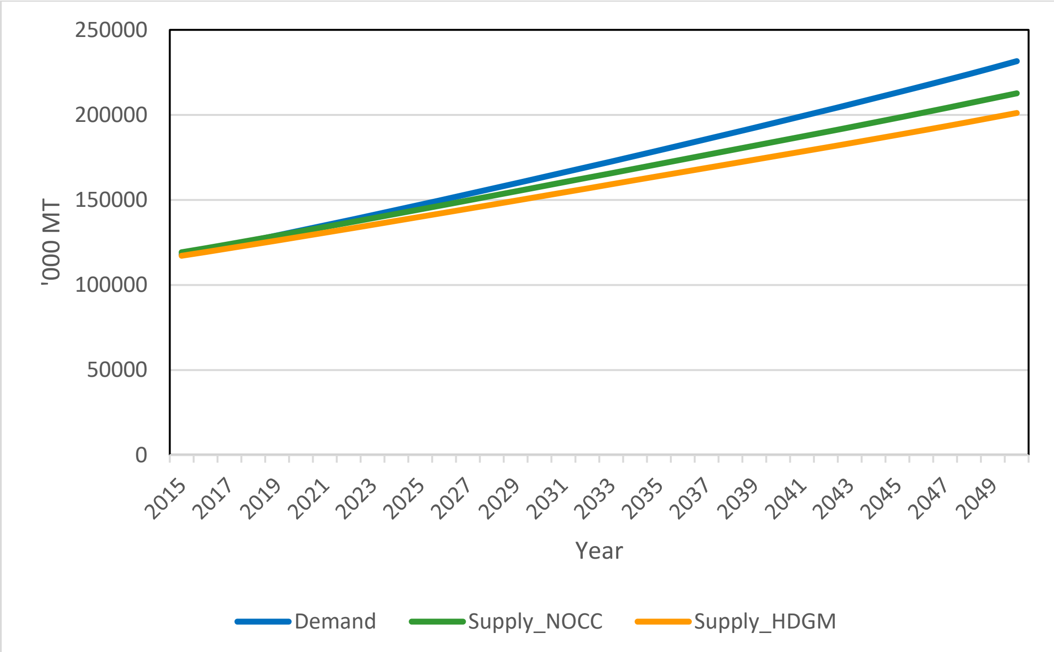

Figure 1: Aggregated supply and demand projection of GLDC crops in LIFDC with and without climate change.

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no climate change and climate change using RCP 8.5 and the Hadley Climate Model.

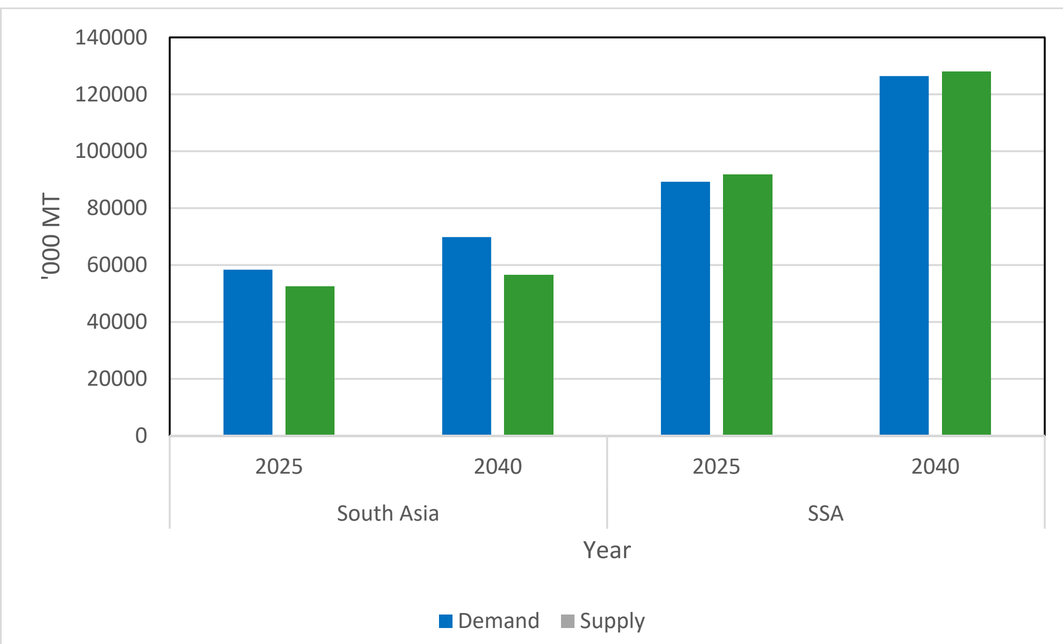

Figure 2: Projected aggregate supply and demand of GLDC crops by region in 2025 and 2040 (in '000 million tons).

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no climate change.

- The aggregate supply and demand projections for the GLDC crops in South Asia and SSA regions show an increasing trend. The demand for GLDC crops in SSA Africa in 2025 is around 80 million tons which increases to 120 million tons in 2040 (Figure 2). This increase in demand is mainly driven by the increase in population in SSA. The estimated figures also show that the supply of GLDC crops in this region are expected to cover its demand both in 2025 and 2040.

- However, the production of GLDC crops in South Asia will be lower than the demand both in 2025 and 2040. Furthermore, the supply-demand gaps for SA will widen in the long term.
- The projected demand shows that the different sources of demand for GLDC crops will be similar in the future in South Asia and SSA (Figure 3).
- The projected food demand will continue to be the major source of demand both in South Asia and SSA in the future. The crop wise disaggregated demand is given in Annex Figures 1 and 2 for South Asia and Africa.
- The share of other demand (include industrial uses) in the total demand for GLDC crops will be increasing in both South Asia and SSA in the future.
- The intermediate demand (grains used to extract oils) for GLDC crops (groundnut and soybean) will increase and will be higher than food, feed and other demands in the future in both South Asia and SSA (Annex Figure 1 and 2).
- Projections of aggregate demand for dryland cereals in South Asia will be higher than the future production for both 2025 and 2040. The demand-supply gap is widening between both periods (Figure 4). However, the demand in SSA will be equal to the production for both 2025 and 2040. The demand will however increase from 65 million tons in 2025 to 93 million tons in 2040.
- The demand for grain legumes grows much faster in SA than the production and it increases the demand-supply gap in the future with current level of productivity growth in grain legumes (Figure 5).
- The production of aggregate grain legumes is higher than the demand in SSA and it is mainly from the area expansion of legumes.
- By 2030 (the target date for the SDGs), the population at risk of hunger is projected to decline from around 800 million people worldwide to around 600 million, with climate change slowing the greater progress that would otherwise have been achieved (Figure 6).

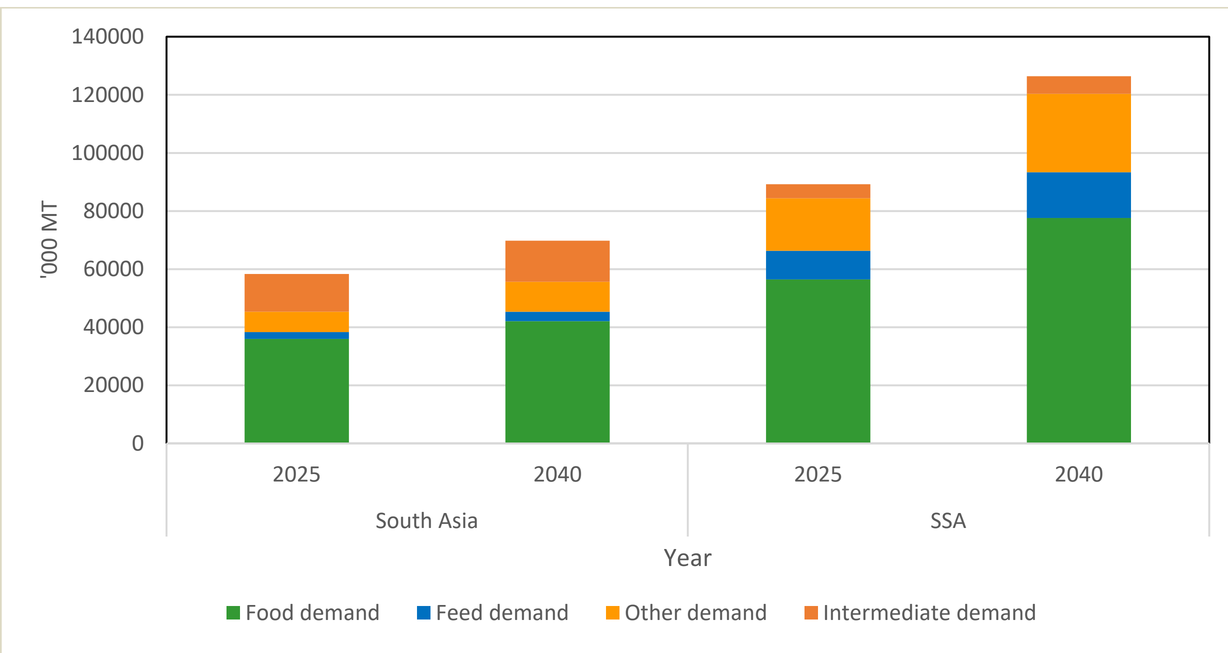

Figure 3: Projected disaggregated sources of demand for GLDC crops by region in 2025 and 2040 (in '000 million tons).

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no climate change.

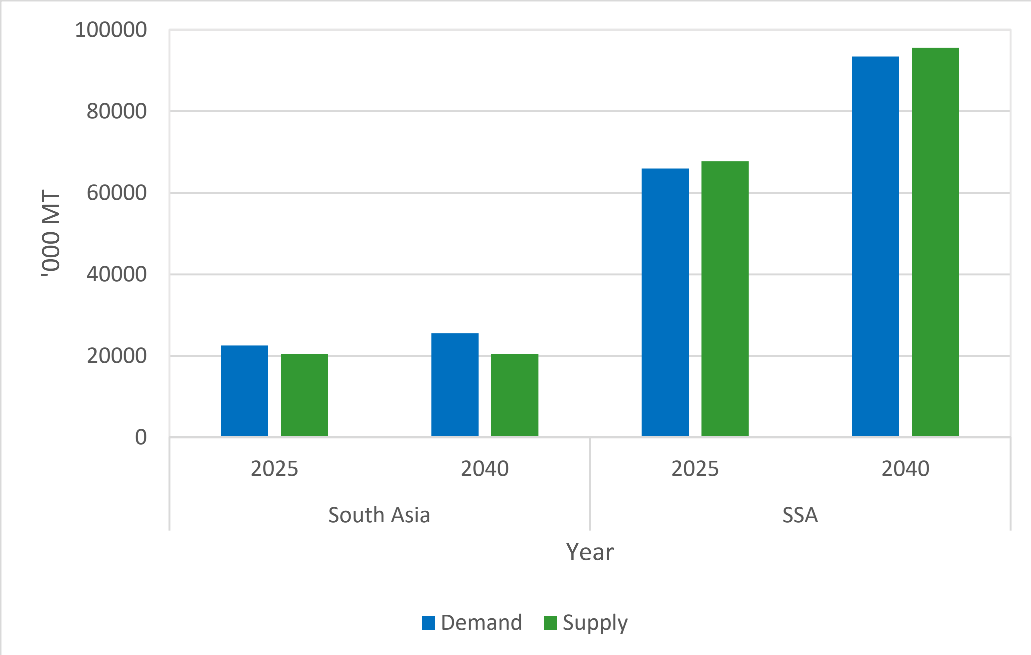

Figure 4. Projected supply and demand of dryland cereals (sorghum and millets) by region in 2025 and 2040 (in '000 million tons).

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no climate change.

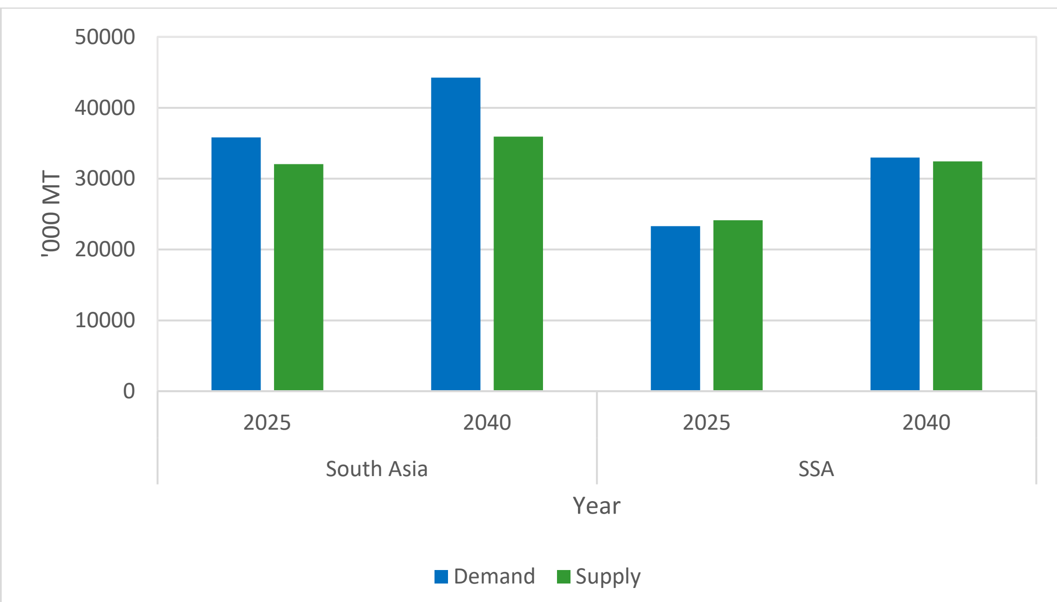

Figure 5. Projected supply and demand of dryland grain legumes (chickpea, cowpea, lentils, pigeonpea and soybean) by region in 2025 and 2040 (in '000 million tons).

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no Climate change

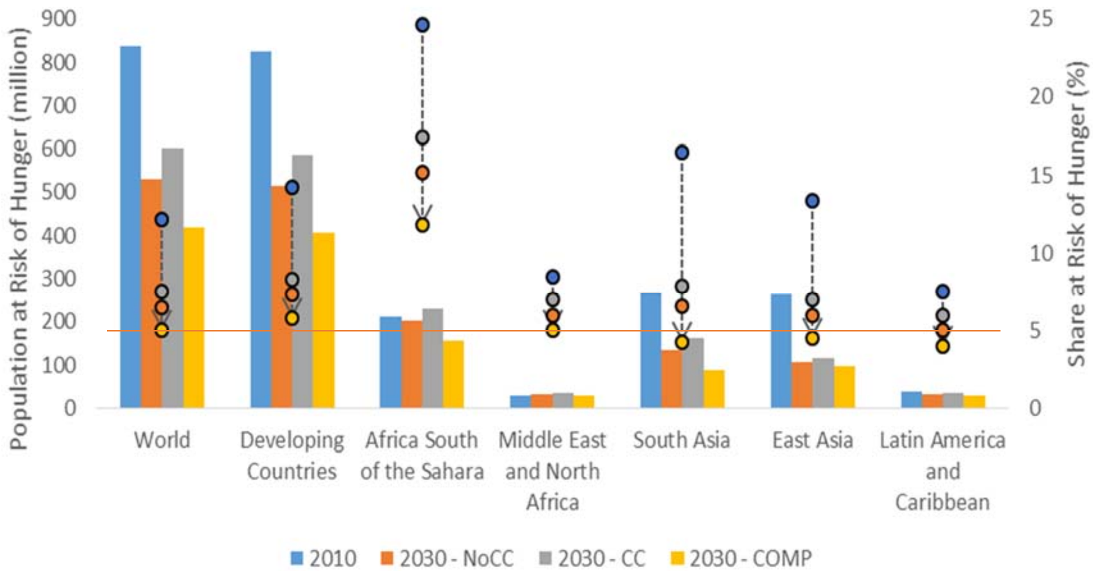

Figure 6: Hunger in 2030 by climate and investment scenarios.

Source: IFPRI, IMPACT model version 3.3, Rosegrant et al. (2017).

Note: Bars showing numbers on the left axis, dots showing shares on the right axis

2030-NoCC assumes a constant 2005 climate; 2030-CC reflects climate change using RCP 8.5 and the Hadley Climate Model, and 2030-COMP assumes climate change plus increased investment in developing countries.

- The improvement is projected to be proportionately greater in South Asia, and less in Africa South of the Sahara. In South Asia (and worldwide), the share of population at risk of hunger is projected to fall below 10% by 2030 (and below 5% with increased investment in agriculture). But in Africa South of the Sahara, the share of population at risk of hunger will remain above 15%, and the number of people at risk of hunger is actually projected to increase, given the continued growth in the overall population.

GLDC crops' projected production, demand and net trade

- The total demand (including food, feed and others) for dryland cereals (sorghum and millets) is increasing in the future in both Asia and SSA. The demand for sorghum in South Asia will increase from 8.9 million tons in 2025 to 10.1 million tons in 2040, but the production in the future will not be sufficient to meet the growing demand. In SSA, especially in WCA, the demand for sorghum will increase from 24 million tons in 2025 to 35 million tons in 2040. The demand-supply gap will also widen in the near future with current level of productivity growth.
- The demand for millets will increase in Asia and SSA but more than 50% of the world's millet demand will be from WCA in 2040. The demand for millets in WCA will increase from 22 million tons in 2025 to 32 million tons in 2040. Demand for millets in South Asia will grow at a slower rate in the future (Table 1).
- Among grain legumes crops, more than 90% of the world's total demand for chickpea, pigeonpea and lentils will be from South Asia.
- Similarly, Africa will account for more than 50% of the world's demand for sorghum, millet and cowpea by 2040. For cowpea, the region will account for about 94% of the world's demand by 2040.
- Chickpea demand in South Asia will increase in the future from 9.4 million tons in 2025 to 11.7 million tons in 2040. The increase in production will not be sufficient to meet the growing demand in the region. Moreover, the demand-supply gap is widening in the future with the current productivity growth.

Table 1: Projected production, demand and net trade to 2025 and 2040 of GLDC crops in different regions.								
Category	**Crops**	**Region**	**Production ('000 MT)**		**Demand ('000 MT)**		**Net trade ('000 MT)**	
			2025	**2040**	**2025**	**2040**	**2025**	**2040**
Cereals	Sorghum	World	85527	109570	83670	107713		
Cereals	Sorghum	Asia	11890	12104	14863	16904	-3015	-4843
Cereals	Sorghum	Eastern Asia	2912	2807	4518	4875	-1606	-2068
Cereals	Sorghum	Southern Asia	7930	7844	8922	10118	-991	-2274
Cereals	Sorghum	Africa	40993	56989	41007	58532	-1828	-3357
Cereals	Sorghum	ESA	9149	14408	8626	12145	369	2109
Cereals	Sorghum	WCA	23999	32517	24182	35463	-882	-3645
Cereals	Millet	World	44967	57744	44333	57110		
Cereals	Millet	Asia	15096	15302	16298	18187	-1202	-2884
Cereals	Millet	Eastern Asia	2008	2016	2117	2128	-109	-112
Cereals	Millet	Southern Asia	12609	12681	13641	15432	-1031	-2751
Cereals	Millet	Africa	27850	39830	26690	37593	526	1603
Cereals	Millet	ESA	3288	5302	2825	3979	463	1323
Cereals	Millet	WCA	23328	32838	22367	31754	326	450
Grain legumes	Groundnut	World	45170	51278	43900	50008		
Grain legumes	Groundnut	Asia	26874	28035	27848	29539	-1824	-2353
Grain legumes	Groundnut	Eastern Asia	15101	16281	17326	18313	-3018	-2824
Grain legumes	Groundnut	Southern Asia	7507	7376	6638	7066	869	310
Grain legumes	Groundnut	Africa	13670	17411	12229	16194	1122	897
Grain legumes	Groundnut	ESA	1692	2211	1454	1975	238	236
Grain legumes	Groundnut	WCA	10794	13823	9424	12510	1051	993
Grain legumes	Chickpea	World	12278	15197	12194	15114		
Grain legumes	Chickpea	Asia	10705	13024	10903	13437	-222	-437
Grain legumes	Chickpea	Eastern Asia	13	14	12	12	1	2
Grain legumes	Chickpea	Southern Asia	9125	11113	9487	11709	-377	-611
Grain legumes	Chickpea	Africa	638	868	776	1106	-139	-238
Grain legumes	Chickpea	ESA	460	615	535	806	-74	-191
Grain Legumes	Chickpea	WCA						
Grain legumes	Pigeonpea	World	5140	6424	5131	6415		
Grain legumes	Pigeonpea	Asia	4513	5602	4371	5411	133	182
Grain legumes	Pigeonpea	Eastern Asia						
Grain legumes	Pigeonpea	Southern Asia	3726	4701	3667	4642	59	59
Grain legumes	Pigeonpea	Africa	570	740	640	867	-70	-127
Grain legumes	Pigeonpea	ESA	558	723	627	845	-68	-123
Grain legumes	Pigeonpea	WCA	12	18	14	22	-1	-4
Grain legumes	Cowpea	World	8536	12842	8504	12810		
Grain legumes	Cowpea	Asia	205	217	535	632	-340	-424
Grain legumes	Cowpea	Eastern Asia						
Grain legumes	Cowpea	Southern Asia	15	19	292	350	-276	-331
Grain legumes	Cowpea	Africa	8150	12348	7835	12024	293	302
Grain legumes	Cowpea	ESA	508	766	637	961	-129	-194
Grain legumes	Cowpea	WCA	7615	11543	7151	11000	441	521
Grain legumes	Lentils	World	5113	6218	4934	6038		
Grain legumes	Lentils	Asia	3024	3544	4122	5074	-1122	-1554
Grain legumes	Lentils	Eastern Asia	177	221	186	196	-9	25
Grain legumes	Lentils	Southern Asia	1732	1970		3626	-1182	-1656
Grain legumes	Lentils	Africa	147	2914	176	251	-29	-64
Grain legumes	Lentils	ESA	96	118	125	189	-29	-71

Grain legumes	Lentils	WCA						
Grain legumes	Soybean	World	295614	338002	289531	331919		
Grain legumes	Soybean	Asia	35445	38572	179472	217320	-144027	-178749
Grain legumes	Soybean	Eastern Asia	22606	24636	114656	131087	-92050	-106451
Grain legumes	Soybean	Southern Asia	10805	11820	34307	44407	-23502	-32587
Grain legumes	Soybean	Africa	1603	1684	18794	24362	-17190	-22678
Grain legumes	Soybean	ESA	752	754	5042	6657	-4290	-5903
Grain legumes	Soybean	WCA	796	866	3462	4950	-2666	-4084

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no climate change.

For soybean, demand includes soybean grain and net imports of soybean oil and cake (converted in grain equivalent).

- Pigeonpea demand in South Asia will increase from 3.6 million tons in 2025 to 4.6 million tons in 2040. The demand for pigeonpea in ESA region will also increase from 0.62 million tons in 2025 to 0.84 million tons in 2040. But productivity growth in the region is not sufficient to meet the growing demand in future.
- In the case of lentils, the projection shows that the net trade in this crop will be characterized by imports in all of the considered regions, with the exception of Eastern Asia. The widest gap between production and supply of lentil is observed in South Asia, where imports of this commodity will grow by around 40% between 2025 and 2040 (from 1.1 million tons to 1.6 million tons). In ESA and WCA, unlike other crops, lentils' net trade will be negative for both African regions in 2025 and 2040. Imports of lentils in these regions will double between 2025 and 2040, showing the crop's major relevance in SSA.
- For cowpea, the bulk of the world's demand would be from the WCA region. The demand for cowpea in WCA in 2025 would reach around 7.8 million tons and it would increase to 11 million tons in 2040. Nigeria is the largest cowpea consumer and producer in the world. When using more realistic elasticity parameters for Nigeria in the IMPACT model, the gap between production and demand in this country would reach 20% of total demand by 2040.
- Groundnut demand for Africa will increase from 12.2 million tons in 2025 to 16.2 million tons in 2040 and major demand (more than 90% of Africa's demand) is from the WCA region. In South Asia, the growth in demand is stagnant and it increases by only 1.6 million tons between 2025 and 2040.

  For soybean, both Asia and SSA have demand-supply deficit and it is growing over the years. In South Asia, to meet growing demand the region requires to import about 23.5 million tons in 2025 and 32.6 million tons in 2040. Africa would be importing more than 90% of its soybean consumption requirement. More specifically, its net soybean imports would increase from 17.2 million tons in 2025 to 22.7 million tons in 2040.

The additional information on GLDC crop wise actual production (three years average of 2012-14), % change in demand of 2025 and 2040 compare to 2010 and projected deficit/surplus in 2025 and 2050 is given Annex Table 1.

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Annex Table 1: Current production, projected change in demand and projected deficit/surplus to 2025 and 2040 of GLDC crops in different countries in South Asia and SSA.							
Country	Crop	Production ('000 MT) 2012-2014	Demand			Projected deficit/surplus (000 MT)[1]	
			'000 MT	% change			
			2010	2025	2040	2025	2040
Benin	Sorghum	111	191	57.8	146.7	36	106
Burkina Faso	Sorghum	1800	1735	50.6	109.0	-143	-354
Ethiopia	Sorghum	3900	2538	41.7	82.3	508	1283
Eritrea	Sorghum	138	238	52.1	114.3	-170	-143
Ghana	Sorghum	265	356	61.3	125.0	134	449
India	Sorghum	5600	7382	17.4	32.7	-951	-2201
Kenya	Sorghum	171	157	67.7	157.6	-3	25
Kazakhstan	Sorghum	0	1	28.8	44.9	0	0
Malawi	Sorghum	77	61	55.6	135.9	-23	-20
Mali	Sorghum	1100	788	49.5	108.4	103	393
Morocco	Sorghum	5	16	21.7	43.3	-16	-14
Mozambique	Sorghum	146	221	47.6	87.0	-32	72
Niger	Sorghum	1400	837	81.4	212.7	488	632
Nigeria	Sorghum	6000	9887	53.4	125.9	-2253	-6542
Nepal	Sorghum		0	27.6	53.1	0	0
Rwanda	Sorghum	146	231	-45.3	-24.3	-52	-84
Senegal	Sorghum	111	150	52.4	113.4	37	117
Sudan	Sorghum	5187	4779	38.1	76.3	-681	-317
Tanzania	Sorghum	851	795	50.5	114.7	614	1745
Uganda	Sorghum	311	617	80.8	217.8	-226	-528
Zambia	Sorghum	14	39	101.4	288.0	-65	-116
Zimbabwe	Sorghum	82	122	22.7	60.0	-35	-13
Benin	Millet	26	45	61.4	169.1	-8	8
Burkina Faso	Millet	1000	1293	52.4	111.4	-168	-251
Ethiopia	Millet	836	493	42.0	78.6	193	555
Eritrea	Millet	26	30	56.0	159.7	15	18
Ghana	Millet	163	190	65.8	133.4	34	138
India	Millet	11000	11004	16.7	31.4	-894	-2515
Kenya	Millet	140	73	62.0	140.8	14	56
Kazakhstan	Millet	35	38	16.5	27.0	17	30
Malawi	Millet	36	27	51.9	122.7	-3	9
Mali	Millet	1500	1176	45.5	100.2	-36	122
Morocco	Millet	6	13	16.8	31.3	0	3
Mozambique	Millet	25	24	46.8	88.7	-5	-2
Myanmar	Millet	225	209	10.3	10.7	44	115
Niger	Millet	3400	2775	58.6	144.5	50	-63
Nigeria	Millet	1200	7706	40.8	97.0	-16	-1275
Nepal	Millet	308	317	27.2	50.4	-77	-122
Rwanda	Millet	4	5	82.1	172.7	-2	-3
Senegal	Millet	529	482	36.4	74.9	223	648
Sudan	Millet	914	1080	36.3	69.5	-261	-170
Tanzania	Millet	266	264	47.2	105.2	98	346
Uganda	Millet	236	785	52.0	124.4	45	80
Vietnam	Millet	2	2	38.2	70.9	0	-1
Zambia	Millet	28	48	92.2	257.4	-15	-51
Zimbabwe	Millet	58	53	16.8	36.9	82	195

Benin	Groundnut	141	108	48.8	100.3	37	31
Burkina Faso	Groundnut	332	214	51.7	104.0	115	262
Ethiopia	Groundnut	113	27	40.2	73.9	11	7
Eritrea	Groundnut	2	2	49.2	100.1	0	-1
Ghana	Groundnut	437	353	46.6	88.1	115	93
India	Groundnut	6900	5427	19.7	27.2	856	297
Kenya	Groundnut	58	18	40.4	74.6	15	21
Kazakhstan	Groundnut	0	1	12.9	21.8	0	0
Malawi	Groundnut	348	146	54.7	129.0	2	-38
Mali	Groundnut	501	201	49.8	112.0	56	46
Morocco	Groundnut	38	38	30.4	53.9	15	17
Mozambique	Groundnut	123	74	48.7	97.1	54	92
Myanmar	Groundnut	854	896	13.9	19.6	256	262
Niger	Groundnut	346	129	45.3	97.9	0	-69
Nigeria	Groundnut	3100	3338	40.8	87.6	-182	-802
Nepal	Groundnut		1	17.3	28.2	-1	-1
Rwanda	Groundnut	12	9	45.6	85.8	3	2
Senegal	Groundnut	680	483	47.1	97.9	271	433
Sudan	Groundnut	1620	736	40.9	83.1	-204	-366
Tanzania	Groundnut	1300	323	51.2	109.5	0	-17
Uganda	Groundnut	295	132	54.2	116.7	21	-36
Vietnam	Groundnut	471	308	15.4	22.2	152	132
Zambia	Groundnut	121	59	56.7	123.9	59	100
Zimbabwe	Groundnut	75	89	15.8	28.1	-11	1
Ethiopia	Chickpea	426	232	63.3	144.7	-35	-112
Eritrea	Chickpea	4	6	49.6	115.7	-2	-2
India	Chickpea	8800	5986	31.8	61.0	-289	-610
Kenya	Chickpea	2	0	48.3	107.6	0	0
Kazakhstan	Chickpea	19	2	25.5	40.4	2	3
Malawi	Chickpea	66	36	61.5	156.3	-4	-18
Morocco	Chickpea	40	52	26.6	48.1	25	53
Myanmar	Chickpea	524	244	24.8	37.2	21	5
Niger	Chickpea	0	0	72.5	198.6	0	0
Nepal	Chickpea	9	11	43.0	99.0	-2	-5
Sudan	Chickpea	14	25	47.0	101.9	-16	-22
Tanzania	Chickpea	109	49	60.7	139.8	-29	-51
Uganda	Chickpea	5	5	70.3	172.7	-3	-7
Zimbabwe	Chickpea	0	1	14.3	34.7	-1	-1
India	Pigeonpea	3000	2637	37.5	74.0	73	85
Kenya	Pigeonpea	203	142	41.6	84.4	-25	-47
Malawi	Pigeonpea	287	104	48.0	110.3	7	-3
Myanmar	Pigeonpea	568	533	19.1	27.6	151	219
Nepal	Pigeonpea	16	22	42.8	99.0	-8	-18
Tanzania	Pigeonpea	234	75	51.1	111.6	-32	-48
Uganda	Pigeonpea	13	108	41.8	83.9	-15	-20
Burkina Faso	Cowpea	580	28	62.4	148.6	362	479
Kenya	Cowpea	128	71	49.9	110.4	-7	16
Malawi	Cowpea	34	64	60.7	156.7	-7	-8
Mali	Cowpea	154	28	56.6	138.3	157	199
Mozambique[2]	Cowpea	93	139	24.3	37.4	-1	1
Myanmar	Cowpea	129	28	74.5	197.0	13	0
Niger	Cowpea	1600	3701	58.4	141.2	1021	1614
Nigeria	Cowpea	4000	24	46.9	107.5	-1018	-1747

Senegal	Cowpea	53	17	46.4	102.1	62	95
Sudan	Cowpea	61	152	59.9	140.2	-8	-10
Tanzania	Cowpea	186	95	69.5	173.2	-87	-164
Uganda	Cowpea	11	46	52.8	132.8	-57	-127
Ethiopia	Lentils	149	71	65.1	150.2	-28	-69
Eritrea	Lentils	0	0	50.0	118.8	0	0
India	Lentils	1100	1533	32.6	63.0	-853	-1191
Kenya	Lentils	4	1	52.9	116.0	0	0
Malawi	Lentils	1	2	63.8	163.6	0	-1
Morocco	Lentils	32	30	27.5	50.1	7	15
Myanmar	Lentils	1	1	26.3	40.0	0	0
Nepal	Lentils	221	199	44.8	104.2	-79	-156
Benin	Soybean	89	11	212.1	187.4	2	2
Burkina Faso	Soybean	20	10	65.2	158.9	15	-2
Ethiopia	Soybean	66	121	42.8	101.2	-19	-46
Ghana	Soybean		28	52.2	116.0	-43	-61
India	Soybean	12000	17193	45.0	91.4	-14525	-21531
Kenya	Soybean	3	36	48.4	118.5	-50	-75
Kazakhstan	Soybean	197	61	25.3	40.4	10	9
Malawi	Soybean	113	138	60.4	166.3	-111	-267
Mali	Soybean	2	3	55.9	149.6	-3	-6
Morocco	Soybean	1	2639	30.6	66.5	-3445	-4392
Mozambique[3]	Soybean	49	161	51.1	120.7	-178	-285
Myanmar	Soybean	160	183	55.3	99.2	-75	-140
Niger	Soybean		6	68.4	192.0	-11	-19
Nigeria	Soybean	616	727	73.5	176.2	-541	-1283
Nepal	Soybean	29	251	46.1	127.3	-342	-545
Rwanda	Soybean	20	44	77.6	185.0	9	-34
Senegal	Soybean		521	38.8	96.1	-723	-1022
Sudan	Soybean		24	37.4	91.3	-33	-46
Tanzania	Soybean	6	10	67.0	170.5	-11	-22
Uganda	Soybean	77	214	70.3	199.4	15	-193
Vietnam	Soybean	166	2494	6.3	8.9	-2387	-2467
Zambia	Soybean	226	97	64.3	171.7	14	-116
Zimbabwe	Soybean	69	217	18.1	66.1	-173	-274

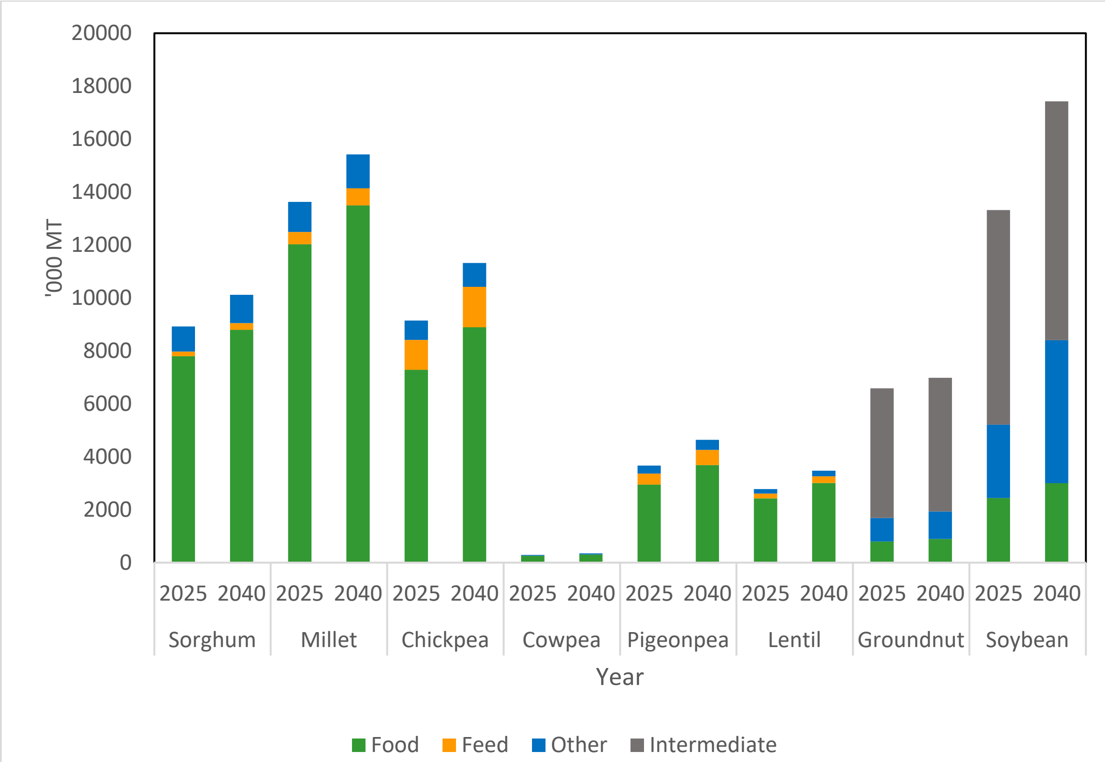
Source: FAOSTAT (production data for 2012-14); IMPACT model version 3.3 (demand projcetions), IFPRI, based on SSP2 with no climate change.

For soybean, demand includes soybean grain and net imports of soybean oil and cake (converted in grain equivalent)

1. deficit/surplus = production - consumption

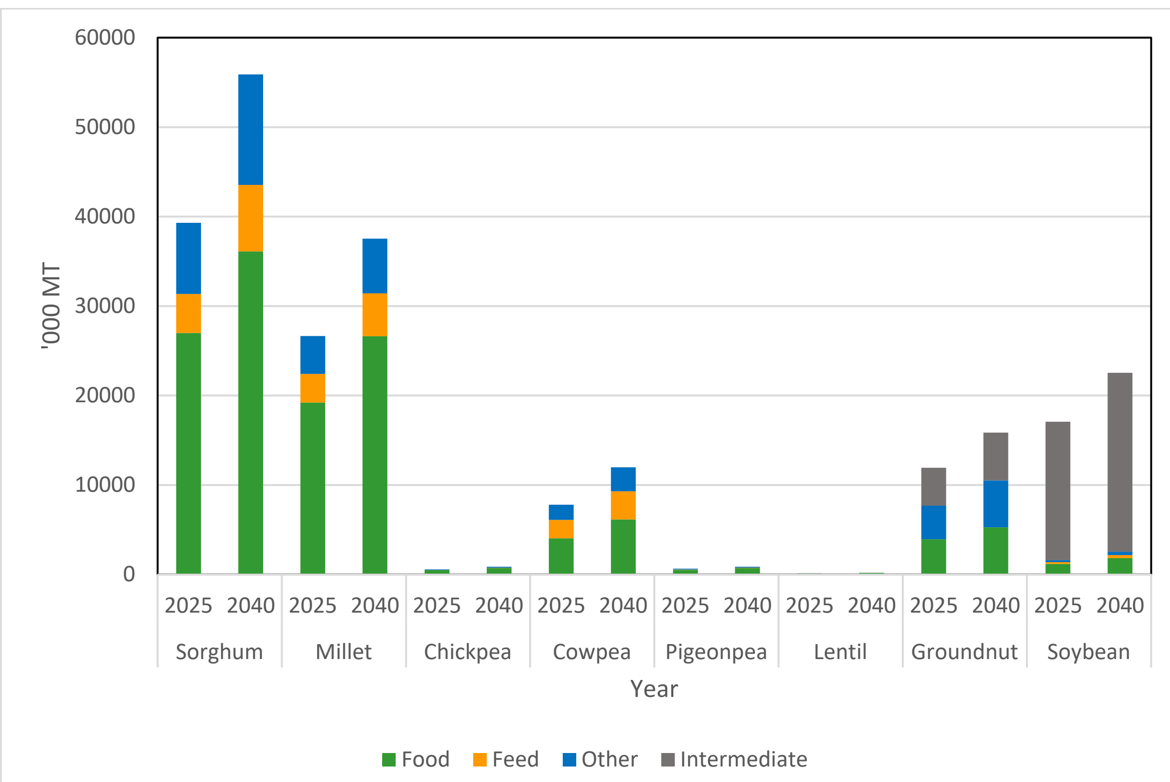
2. 2010 cowpea demand = production from FAOSTAT (average 2009/11); growth rates were computed using results from IMPACT (average growth rates for cowpea consumption and production in southern Africa).

3. Estimated production level in the country for 2014; production was then projected using growth rates from IMPACT results for soybean in southern Africa. For cowpea, base values in IMPACT for countries in West Africa were adjusted based on Langyintuo et al. (2003). For soybean, demand consists of soybean grain and net imports of soybean oil and cake (converted in grain equivalent); in addition for countries in SSA, IPRs in IMPACT were adjusted to reflect substantial production growth which occurred between 2005 and 2011.



Annex Figure 1. Projected crop wise disaggregated demand in South Asia.

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no Climate change



Annex Figure 2. Projected crop wise structure of demand in Africa.

Source: IMPACT version 3.3, IFPRI, based on SSP2 with no Climate change