MSc Student Search – Working Title: Estimation of genetic gains from on-going field trials in sweetpotato for East- and Southern Africa

The International Potato Center (CIP) together with the University of Hohenheim and the working group of Hans-Peter Piepho is supporting a Junior Scientist with a bachelor's in agriculture or related sciences in the frame of the ATSAF - CGIAR++ Junior Scientist Program. The prerequisite to obtain CIP support is that the student is willing to conduct a master with the working title estimation of genetic gains in plant breeding statistics. The call is open to all nationalities, but it requires that the student is accepted as a master student and matriculates at a German University, in the case of the supported study the University of Hohenheim. During the covid-19 crisis the master can be conducted remote and no travels are required. Potential applicants for the research topic must obtain first a letter of support by CIP through:

Dr. Bert De Boeck – CIP-Lima; email: B.DeBoeck@cgiar.org

or

Prof. Hans-Peter Piepho – University Hohenheim; email: hans-peter.piepho@uni-hohenheim.de

Provided the support letter is given CIP will provide further assistance to the application to ATSAF - further details for the potential candidate is provided below.

CIP has estimated genetic gains so far from so called "Modified Demonstration Trials" in which old variety releases are compared with new variety releases (Table 1). This was carried out in the frame of the so-called SASHA project (phase II) from 2014-2019 funded by the BMGF. A new project called "SweetGAINS" and funded by the BMGF is targeting the modernization of sweetpotato breeding in East– and Southern Africa. In this project, it shall be investigated if the available historical data from advanced yield trials and/or variety release trials in East Africa (focus Uganda) and Southern Africa (focus Mozambique) allows to estimate genetic gains from on-going trials such as advanced yield trials of breeders and/or official variety release trials (standard procedure in Europe). One approach to modelling trend that will be used is that described in Piepho et al. (2014, TAG 127, 1009-1018). At both locations (Uganda and Mozambique) CIP has offices, field capacity, and administrative support staff. The successful candidate will work together with staff from CIP-HQ (statistician, breeder), CIP-Uganda (breeder), and CIP-Mozambique (breeder) on the estimation of genetic gains in "SweetGAINS". Travels (incl. per diem) and supplies will be fully covered by CIP, and it could be possible to top up grants provided to MSc Students (donor of grants need to agree). However, during the entire covid-19 crisis travels will not be done and the successful candidate is requested to work remote. When the covid-19 crisis has passed the candidate must be willing to travel and to stay for at least two months in East Africa (Uganda / perhaps neighboring countries) or Southern Africa (Mozambique / perhaps neighboring countries). In case the covid-19 crisis takes longer as expected the master can be completed without travels. The required data sets from advanced yield trials and varieties release trials are available for Uganda and Mozambique and cover a period of 10 years. Since such trials allow the estimation of variance components to optimized breeding scenarios this MSc thesis could be later used for a PhD thesis to optimize breeding schemes in later breeding stages of sweetpotato in East- and Southern Africa. Computer and software will be provided by CIP. Proficiency in the English language is required. Statistical support will be provided by CIP statistician (international staff) and a German

University. All communication (written and oral) will be in English. The candidate will work close to CIP breeders in Uganda and Mozambique (international staff).

Table 1. Annual genetic gains by regions estimated from modified demonstration trials on basis of variety releases across two decades (updated October 2019, estimates by lsmeans followed by regression analysis).

Agro-ecological zone	Genetic gain parameters and year period considered	Storage root yield (90 days harvest) t/ha	Storage root yield (120 days harvest) t/ha	Foliage yield (90 days harvest) t/ha	Foliage yield (120 days harvest) t/ha	β-carotene (120 days harvest) mg / 100g root fresh weight
Arid Pacific coast	release period	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014
	Baseline	5.1	10.1	43.1	52.4	0.68
Ng = 17	annual gain	0.29*	0.47*	-0.31$^{n.s.}$	-0.34$^{n.s.}$	0.27*
Ne = 3	predicted eoop[ǂ]	11.5	20.4	36.3	44.9	6.64
	est. gain eoop %	2.5%	2.3%	-0.9%	-0.8%	4.1%
Amazon basin[#]	release period	1992-2014	1992-2014	1992-2014	1992-2014	1992-2014
	Baseline	5.6	9.2	34.5	26.2	0.92
Ng=17	annual gain	0.30*	0.49*	0.04$^{n.s.}$	-0.02$^{n.s.}$	0.32*
Ne=6	predicted eoop[ǂ]	12.1	20.1	35.4	25.7	7.87
	est. gain eoop %	2.4%	2.5%	0.1%	-0.1%	4.0%
Southern Africa	release period	n.a.	2000-2016	n.a.	2000-2016	2000-2016
	Baseline	n.a.	7.1	n.a.	14.5	4.6
Ng=31	annual gain	n.a.	0.17*	n.a.	0.23*	0.05$^{n.s.}$
Ne=16	predicted eoop	n.a.	9.8	n.a.	18.2	5.42
	est. gain eoop %	n.a.	1.7%	n.a.	1.2%	1.0%
East Africa	release period	n.a.	1995-2013	n.a.	1995-2013	1995-2013
Ng = 17	Baseline	n.a.	9.7	n.a	21.8	-0.06
Ne = 6	annual gain	n.a.	0.40$^{n.s.}$	n.a	-0.05$^{n.s.}$	0.35*
	predicted eoop	n.a.	16.9	n.a.	21.0	6.2
	est. gain eoop %	n.a.	2.4%	n.a.	-0.2%	5.6%
West Africa (Ghana[##])	release period	n.a.	1999-2015	n.a.	1999-2015	1999-2015
	Baseline	n.a.	7.6 (6.0)	n.a	15.6 (14.6)	-0.07 (0.95)
Ng = 14 (10[##])	annual gain	n.a.	0.04$^{n.s}$	n.a	-0.27$^{n.s}$	0.20$^{n.s}$
Ne = 9 (9[##])			(0.35$^{n.s}$)		(-0.08 $^{n.s}$)	(-0.025$^{n.s}$)
	predicted eoop	n.a.	8.3 (12.0)	n.a.	11.0 (13.2)	3.3 (0.53)
	est. gain eoop %	n.a.	0.5% (2.9%)	n.a.	-1.9% (-2.5%)	6.0% (-4.6%)

Ng, number of genotypes; Ne, number of environments; n.p., so far not predicted; n.a., not available; n.s., not significant, .

[ǂ] eoop, end of observation period that is 2014, 2014, 2016, 2013, and 2015 for Arid Pacific coast, Amazon basin, Southern Africa, East Africa, West Africa (Ghana).

[#] assumed to be transferable to other humid topical zones with high rainfall.

[##] in brackets only Ghanaian genotypes, all genotypes from Burkina Faso and Nigeria excluded.