

SUPPLEMENTARY MATERIALS

Supplementary Table S1. Indicator weed species with their functional traits in fields planted with herbicide tolerant (Glyphosate) maize.

Acronym	Scientific Name	Family	Photosynthetic Pathway	Carbon Storage in Reserve Organ	Life Form	Growth Form	Life Span	Seed Size
AMAVIR	<i>Amaranthus viridis</i> L.	Amaranthaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length <2mm
ARGMEX	<i>Argemone mexicana</i> L.	Papaveraceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Rosette growth form	Annual life span	Seed size length <2mm
ARIABY	<i>Aristea abyssinica</i> Pax	Iridaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Geophyte life form	Tufted growth form	Perennial life span	Seed size length 2-<4mm
BERONO	<i>Berkheya onopordifolia</i> (DC.) O.Hoffm. Ex	Asteraceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Geophyte life form	Erect growth form	Perennial life span	Seed size length <2mm
BIDBIP	<i>Bidens bipinnata</i> L.	Asteraceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length >10mm
BIDPIL	<i>Bidens pilosa</i> L.	Asteraceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length >10mm
BRODIA	<i>Bromus diandrus</i> Roth	Poaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Tufted growth form	Annual life span	Seed size length >10mm
BULHUM	<i>Bulbostylis humilis</i> (Kunth) C.B.Clarke	Cyperaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Tussock growth form	Annual life span	Seed size length <2mm
CALSER	<i>Callicoma serratifolia</i> Andrews	Cunoniaceae	Photosynthetic pathway CAM	No specialised carbon storage organs	Phanerophyte life form	Erect growth form	Perennial life span	Seed size length <2mm
CHAPRO	<i>Chamaesyce prostrata</i> (Aiton) Small	Euphorbiaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Creeper growth form	Annual life span	Seed size length <2mm
CHAHED	<i>Chascanum hederaceum</i> (Sond.) Moldenke	Verbenaceae	Photosynthetic pathway CAM	No specialised carbon storage organs	Chamaephyte life form	Erect growth form	Perennial life span	Seed size length <2mm
CHECAR	<i>Chenopodium carinatum</i> R.Br.	Chenopodiaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length 4-10mm
CIRVUL	<i>Cirsium vulgare</i> (Savi) Ten.	Asteraceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Hemicryptophyte life form	Erect growth form	Biennial life span	Seed size length 4-10mm
CONBON	<i>Conyza bonariensis</i> (L.) Cronquist	Asteraceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Rosette growth form	Annual life span	Seed size length <2mm
COTHET	<i>Cotula heterocarpa</i> DC.	Asteraceae	Photosynthetic pathway CAM	No specialised carbon storage organs	Chamaephyte life form	Erect growth form	Perennial life span	Seed size length <2mm
CYPCON	<i>Cyperus congestus</i> Vahl	Cyperaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Hemicryptophyte life form	Tussock growth form	Perennial life span	Seed size length <2mm
CYPESC	<i>Cyperus esculentus</i> L.	Cyperaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Hemicryptophyte life form	Erect growth form	Perennial life span	Seed size length >10mm
CYSPPP	<i>Cyperus</i> spp. L.	Cyperaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Hemicryptophyte life form	Erect growth form	Perennial life span	Seed size length >10mm
DAUCAR	<i>Daucus carota</i> L.	Apiaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Erect growth form	Biennial life span	Seed size length 2-<4mm
ELECOR	<i>Eleusine coracana</i> (L.) Gaertn.	Poaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length <2mm
GALPAR	<i>Galinsoga parviflora</i> Cav.	Asteraceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length <2mm
GISPHA	<i>Gisekia pharnacioides</i> L.	Gisekiaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Prostrate growth form	Annual life span	Seed size length <2mm

HIBNIG	<i>Hibiscus nigricaulis</i> Baker f.	Malvaceae	Photosynthetic pathway CAM	No specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length <2mm
HIBTRI	<i>Hibiscus trionum</i> L.	Malvaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length <2mm
INDSPI	<i>Indigofera spicata</i> Forsk.	Fabaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Creeper growth form	Annual life span	Seed size length <2mm
IPOPUR	<i>Ipomoea purpurea</i> (L.) Roth	Convolvulaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Creeper growth form	Annual life span	Seed size length 4-10mm
LOBERI	<i>Lobelia erinus</i> L.	Campanulaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Perennial life span	Seed size length <2mm
MEDPOL	<i>Medicago polymorpha</i> L.	Fabaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Prostrate growth form	Annual life span	Seed size length 2-<4mm
ONCPIL	<i>Oncosiphon piluliferum</i> (L.f.) Källersjö	Asteraceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Hemicryptophyte life form	Erect growth form	Annual life span	Seed size length <2mm
PLAVIR	<i>Plantago virginica</i> L.	Plantaginaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Perennial life span	Seed size length 2-<4mm
POLAMA	<i>Polygala amatymbica</i> Eckl. & Zeyh.	Polygalaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Chamaephyte life form	Erect growth form	Perennial life span	Seed size length 4-10mm
POROLE	<i>Portulaca oleracea</i> L.	Portulacaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Prostrate growth form	Annual life span	Seed size length 4-10mm
RORNUD	<i>Rorippa nudiuscula</i> Thell.	Brassicaceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Erect growth form	Perennial life span	Seed size length <2mm
SOLRET	<i>Solanum retroflexum</i> Dunal	Solanaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Phanerophyte life form	Erect growth form	Annual life span	Seed size length 4-10mm
SOLRIG	<i>Solanum rigescens</i> Jacq.	Solanaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Phanerophyte life form	Erect growth form	Annual life span	Seed size length 4-10mm
SONASP	<i>Sonchus asper</i> (L.) Hill	Asteraceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Rosette growth form	Annual life span	Seed size length 2-<4mm
SONNAN	<i>Sonchus nanus</i> Sond. ex Harv.	Asteraceae	Photosynthetic pathway C ₄	Specialised carbon storage organs	Therophyte life form	Rosette growth form	Perennial life span	Seed size length 2-<4mm
TEPCAP	<i>Tephrosia capensis</i> (Jacq.) Pers.	Fabaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Chamaephyte life form	Erect growth form	Perennial life span	Seed size length <2mm
TRIREF	<i>Trifolium repens</i> L.	Fabaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Hemicryptophyte life form	Creeper growth form	Perennial life span	Seed size length <2mm
URTURE	<i>Urtica urens</i> L.	Urticaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length <2mm
XANSPI	<i>Xanthium spinosum</i> L.	Asteraceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Erect growth form	Annual life span	Seed size length >10mm
ZORCAP	<i>Zornia capensis</i> Pers.	Fabaceae	Photosynthetic pathway C ₃	Specialised carbon storage organs	Therophyte life form	Creeper growth form	Perennial life span	Seed size length 2-<4mm

Supplementary Table S2. Description of plant functional traits.

Plant functional traits	Description
Growth form	The form assumed by a plant in immediate response to the interaction of a particular environment on its genetic potentialities.
Annual life form	Plants that go from seed to seed in one year (they grow, mature, bloom, produce seed and die).
Perennial and biennial life form	Plants that persist for several years, usually with new herbaceous growth from a part that survives from growing season to growing season.
Monocotyledonous	Are grass and grass-like flowering plants, and the seeds of which typically contain only one embryonic leaf.
Dicotyledonous	Flowering plants that have a pair of leaves, or cotyledons, in the embryo of the seed.
Prostrate growing	It is a trait of plant that has branches spreading along the ground for most of its length but with tips turning upwards.
Erect growing	It is a trait where plants have stem growing vertically or upwards.
Nitrogen fixing	Plants whose roots are colonised by certain bacteria that extract nitrogen from the air and convert it into a form required for their growth.
Non-nitrogen fixing	Plants that are not capable of transforming nitrogen into fixed nitrogen that is usable by plants.
Spinescent	It is a plant trait that refers to the presence of any sharp pointed tip on any part of the plant including spines.
Non-spinescent	It is a plant trait that refers to the absence of any sharp pointed tip on any part of the plant.
Assisted seed dispersal	It is a plant trait where seeds are aided by wind or other species to be transported over a long distance before being deposited.
Unassisted seed dispersal	It is a plant trait where seeds are not aided by wind or other species to be transported over a long distance before being deposited.
Specified flowering season	Plant trait that refers to the window of time when a flower naturally blooms in each locale.
Specialised carbon storage organs with C ₄ photosynthetic pathway	It is a plant trait where C ₄ plants minimise photorespiration by separating initial fixation and the Calvin cycle in space, performing these steps in different cell types
Specialised carbon storage organs with C ₃ photosynthetic pathway	It is a plant trait where a plant does not have a photosynthetic adaptation to reduce photorespiration.

Supplementary Table S3. Dissimilarity in weed trait assemblages across maize field sites at $p < 0.05$.

MF Sites	T	P (perm)
MV vs BM	3.417	0.001
MV vs MJN	2.135	0.002
MV vs T	3.025	0.001
BM vs MJN	2.001	0.004
BM vs T	1.541	0.057
MJN vs T	1.317	0.115
Pre vs Post herbicide application	-	0.003

MF= Maize fields; MV= Baziya Makaula; MJN=Baziya Jojweni; BM= Baziya Mission; p -values in red indicate significant difference at $p < 0.05$.

Supplementary Table S4. List of species recorded for maize fields and margins in Baziya and Tsolo.

Family	Scientific Name	Common Name	Growth form	Indigenous/Alien	Maize fields (MF)	Field margins (M)
Amaranthaceae	<i>Amaranthus viridis</i> L.	Spiny pigweed	Forb	Alien	Present	Present
Apiaceae	<i>Daucus carota</i> L.	Wild carrot	Forb	Alien	Present	Present
Asparagaceae	<i>Asparagus species</i> L.	Asparagus	Forb	Indigenous	Absent	Present
Asteraceae	<i>Arctotheca calendula</i> K. Lewin	Capeweed	Forb	Indigenous	Present	Present
Asteraceae	<i>Berkheya onopordifolia</i> (DC.) O. Hoffm. Ex	Purple berkheya	Forb	Indigenous	Present	Absent
Asteraceae	<i>Bidens bipinnata</i> L.	Spanish needles	Forb	Alien	Present	Present
Asteraceae	<i>Bidens pilosa</i> L.	Jersey cudweed	Forb	Alien	Present	Present
Asteraceae	<i>Cirsium vulgare</i> (Savi) Ten.	Spear thistle	Forb	Alien	Present	Absent
Asteraceae	<i>Conyza bonariensis</i> (L.) Cronquist	Argentine fleabane	Forb	Alien	Present	Present
Asteraceae	<i>Cotula heterocarpa</i> DC.	Water buttons	Forb	Indigenous	Present	Present
Asteraceae	<i>Galinsoga parviflora</i> Cav.	Galant soldier	Forb	Alien	Present	Absent
Asteraceae	<i>Helichrysum asperum</i> (Thunb.) Hilliard & B.L. Burtt	Hairy everlasting	Forb	Indigenous	Present	Present
Asteraceae	<i>Helichrysum gneseolanatum</i> Hilliard	Fluffy white	Forb	Indigenous	Present	Present
Asteraceae	<i>Oncosiphon piluliferum</i> (L.f.) Kallersjö	Pineapple weed	Forb	Indigenous	Present	Absent
Asteraceae	<i>Pseudognaphalium luteoalbum</i> (L.) Hilliard & B.L. Burtt	Jersey cudweed	Forb	Indigenous	Present	Present
Asteraceae	<i>Sonchus asper</i> (L.) Hill	Prickly sow-thistle	Forb	Alien	Present	Present
Asteraceae	<i>Sonchus nanus</i> Sond. ex Harv.	Southistle	Forb	Alien	Present	Present
Asteraceae	<i>Tagetes minuta</i> L.	Khaki weed	Forb	Alien	Present	Present
Asteraceae	<i>Xanthium spinosum</i> L.	Spiny cocklebur	Forb	Alien	Present	Present
Brassicaceae	<i>Rorippa nudiuscula</i> Thell.	Yellowcresses	Forb	Alien	Present	Present
Campanulaceae	<i>Lobelia erinus</i> L.	Garden lobelia	Forb	Indigenous	Present	Present
Campanulaceae	<i>Wahlenbergia stellarioides</i> Cham.	Tufted bluebell	Forb	Indigenous	Present	Present
Chenopodiaceae	<i>Chenopodium carinatum</i> R.Br.	Keeled goosefoot	Forb	Alien	Present	Present
Cleomaceae	<i>Cleome monophylla</i> L.	Rocky mountain beeplant	Forb	Indigenous	Present	Absent
Commelinaceae	<i>Commelina benghalensis</i>	Benghal dayflower	Forb	Alien	Present	Present
Convolvulaceae	<i>Ipomoea purpurea</i> (L.) Roth	Common morning glory	Forb	Alien	Present	Present
Convolvulaceae	<i>Ipomoea spp.</i> L.	Bindweed	Forb	Alien	Present	Absent
Cucurbitaceae	<i>Cucumis myriocarpus</i> Naudin	Gooseberry cucumber	Forb	Indigenous	Present	Present
Cunoniaceae	<i>Callioma serratifolia</i> Andrews	Black wattle	Forb	Alien	Present	Present
Cyperaceae	<i>Bulbostylis humilis</i> (Kunth) C.B. Clarke	Bushy heads grass	Sedge	Indigenous	Present	Absent
Cyperaceae	<i>Cyperus congestus</i> Vahl	Nut grass	Sedge	Indigenous	Present	Absent
Cyperaceae	<i>Cyperus esculentus</i> L.	Tigermat	Sedge	Indigenous	Present	Absent
Cyperaceae	<i>Cyperus spp.</i> L.	Sedges	Sedge	Indigenous	Present	Present
Euphorbiaceae	<i>Chamaesyce prostrata</i> (Aiton) Small	Green creeping spurge	Forb	Alien	Present	Present
Euphorbiaceae	<i>Ricinus communis</i> L.	Castor bean	Forb	Alien	Present	Absent
Fabaceae	<i>Alysicarpus rugosus</i> (Willd.) DC.	Red moneywort	Forb	Indigenous	Present	Present
Fabaceae	<i>Chamaecrista biensis</i> (Steyart) Mendonca & Torre	Locust weed	Forb	Indigenous	Present	Present
Fabaceae	<i>Indigofera spicata</i> Forsk.	True indigo	Forb	Indigenous	Present	Absent
Fabaceae	<i>Lespedeza pilosa</i> (Thunb.) Siebold & Zucc.	Carlifonia bush clover	Forb	Alien	Present	Absent
Fabaceae	<i>Medicago polymorpha</i> L.	California burclover	Forb	Indigenous	Present	Present
Fabaceae	<i>Tephrosia capensis</i> (Jacq.) Pers.	Tephrosia fern	Forb	Alien	Present	Present
Fabaceae	<i>Trifolium repens</i> L.	White clover	Forb	Alien	Present	Present
Fabaceae	<i>Zornia capensis</i> Pers.	Caterpillar bean	Forb	Indigenous	Present	Present
Gisekiaceae	<i>Gisekia pharmacoides</i> L.	Sand herbage	Forb	Alien	Present	Present
Hypoxidaceae	<i>Hypoxis villosa</i> L.f.	Golden winter star	Forb	Indigenous	Present	Present
Indaceae	<i>Anistea abyssinica</i> Pax	Blue-eyed grass	Forb	Indigenous	Present	Absent
Malvaceae	<i>Hibiscus nigricaulis</i> Baker f.	Wild stockrose	Forb	Indigenous	Present	Absent
Malvaceae	<i>Hibiscus trionum</i> L.	Flower-of-an-hour	Forb	Indigenous	Present	Present
Onagraceae	<i>Oenothera parodiana</i> Munz	Evening primrose	Forb	Alien	Present	Present
Papaveraceae	<i>Argemone mexicana</i> L.	Mexican pinkly poppy	Forb	Alien	Present	Absent
Papaveraceae	<i>Papaver aculeatum</i> Thunb.	Orange poppy	Forb	Indigenous	Present	Absent
Plantaginaceae	<i>Diclis reptans</i> Benth.	Toadflax	Forb	Indigenous	Present	Present
Plantaginaceae	<i>Plantago virginica</i> L.	Dwarf plantain	Forb	Alien	Present	Present
Poaceae	<i>Andropogon eucomis</i> Nees	Snowflake grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Arundinella nepalensis</i> var. <i>contracta</i> Ohwi	Tambuki grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Bracharia deflexa</i> (Schumach.) Robyns	Congo signal grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Bracharia eruciformis</i> var. <i>divaricata</i> Basappa & Munir.	Velvet bushwillow	Grass	Indigenous	Absent	Present
Poaceae	<i>Bromus diandrus</i> Roth	Great brome	Grass	Alien	Present	Absent
Poaceae	<i>Cynodon dactylon</i> (L.) Pers.	Couch grass	Grass	Alien	Present	Present
Poaceae	<i>Digitaria argyrograptia</i> (Nees) Stapf	Silver finger grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Echinochloa crus-galli</i> (L.) P. Beauv.	Cockspar grass	Grass	Alien	Present	Absent
Poaceae	<i>Eleusine coracana</i> (L.) Gaertn.	Goose grass	Grass	Indigenous	Present	Present
Poaceae	<i>Elionurus muticus</i> (Spreng.) Kuntze	Wire lemon grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Enneapogon scaber</i> Lehm.	Enneapogon	Grass	Alien	Present	Present
Poaceae	<i>Eragrostis curvula</i> (Schrad.) Nees	Love grass	Grass	Indigenous	Present	Absent
Poaceae	<i>Eragrostis plana</i> Nees	Eragrostis	Grass	Indigenous	Present	Present
Poaceae	<i>Lolium perenne</i> L.	Perennial ryegrass	Grass	Alien	Absent	Present
Poaceae	<i>Melinis repens</i> (Willd.) Zizka	Rose Natal grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Panicum ecklonii</i> Nees	Bajiho	Grass	Indigenous	Absent	Present
Poaceae	<i>Panicum natalense</i> Hochst.	Natal buffalo grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Panicum schinzii</i> Hack.	Land grass	Grass	Indigenous	Present	Absent
Poaceae	<i>Paspalum dilatatum</i> Poir.	Paspalum spp	Grass	Alien	Present	Absent
Poaceae	<i>Pennisetum thunbergii</i> Kunth	Fountain grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	Rush grass	Grass	Indigenous	Absent	Present
Poaceae	<i>Nassella neesiana</i> (Trin. & Rupr.) Barkworth	Stipagrostis spp	Grass	Alien	Present	Absent
Poaceae	<i>Themedia triandra</i> Forssk.	Red oat grass	Grass	Indigenous	Present	Present
Poaceae	<i>Urochloa panicoides</i> P. Beauv.	Panic liverseed grass	Grass	Indigenous	Present	Present
Polygalaceae	<i>Polygala amatymbica</i> Eckl. & Zeyh.	Clump forming plant	Forb	Indigenous	Present	Absent
Portulacaceae	<i>Portulaca oleracea</i> L.	Pigweed	Forb	Alien	Present	Present
Rubiaceae	<i>Richardia brasiliensis</i> Gomes	Tropical Mexican clover	Forb	Alien	Present	Present
Scrophulariaceae	<i>Jamesbrittenia aurantiaca</i> (Burch.) Hilliard	Terracotta gazania	Forb	Indigenous	Absent	Absent
Solanaceae	<i>Datura stramonium</i> L.	Jimson weed	Forb	Alien	Present	Absent
Solanaceae	<i>Solanum retroflexum</i> Dunal	Earleaf nightshade	Forb	Alien	Present	Present
Solanaceae	<i>Solanum rigescens</i> Jacq.	Flannel weed	Forb	Alien	Present	Present
Urticaceae	<i>Urtica urens</i> L.	Dwarf nettle	Forb	Alien	Present	Absent
Verbenaceae	<i>Chascanum hederaceum</i> (Sond.) Moldenke	White trumpets	Forb	Indigenous	Present	Present
Verbenaceae	<i>Verbena bonariensis</i> L.	Tall verbena	Forb	Alien	Present	Present
Zygophyllaceae	<i>Tribulus terrestris</i> L.	Tack weed	Forb	Indigenous	Present	Absent