

Minimum Data Sets (MDS): Natural Farming Model Farms

Mandatory Data Sets

S. No.	Parameter	Method/Device	Unit
General			
1.1	Latitude	Handheld GPS/GNSS receiver or mobile GPS app; record in decimal degrees; average ≥ 30 sec fix	degrees
1.2	Longitude	Handheld GPS/GNSS receiver or mobile GPS app; record in decimal degrees; average ≥ 30 sec fix	degrees
1.3	Altitude	GPS altitude/barometric altimeter; cross-check with SRTM/DEM if available	meter
1.4	.kml file	Export waypoints/field boundary from GPS/mobile app (e.g., SW Maps, QField, Google Earth) as .kml	-
1.5	Water source – Ground water	Field survey & farmer interview; GPS-tag well/bore locations; photograph	-
1.6	Water source – Surface water	Field survey & farmer interview; GPS-tag canal/pond locations; photograph	-
Below ground			
1.7	Soil type (nomenclature)	Field survey & profile description; classify as per NBSS&LUP/Soil Taxonomy/WRB	-
1.8	Soil depth	Auger/probe and profile pit measurement at representative points	cm
1.9	Series	Assign soil series using NBSS&LUP soil maps/legends & field correlation	-
1.10	Texture (sand/silt/clay)	Laboratory hydrometer (Bouyoucos) or pipette method on <2 mm fraction	-
2.1	Bulk density	Undisturbed core method (cylindrical core of known volume); oven-dry at 105 °C	g/cc
2.2	Penetration	Cone penetrometer (hand/digital) to	m

		required depth; record peak resistance	
2.3	SOC at 0–15 and 15–30 cm depth	Walkley–Black wet oxidation	%
2.4	Soil pH	pH meter in 1:2.5 soil:water suspension after 30 min equilibration	-
2.5	EC	EC meter on 1:2.5 soil:water extract at 25 °C	dS/m
2.6	Total and Available NPK	Total N: Kjeldahl; Available N: alkaline KMnO ₄ (Subbiah & Asija); Available P: Olsen (pH≥7) or Bray ¹ (pH<7); Available K: 1N NH ₄ OAc extraction with flame photometer/ICP-OES	kg/ha
2.7	Water table level from surface	Observation well/piezometer with electric water level indicator or measuring tape	m
2.8	Earthworm count	Fixed quadrat hand-sorting and/or dilute formalin (0.2%) expulsion; count per m ²	no/m ²
Above ground (Season-wise for Kharif, Rabi and Summer separately)			
3.1	Crop	Field record/farmer register	-
3.2	Variety	Seed lot/label & farmer record verification; photo-documentation	-
3.3	Sowing/Harvest date	Field log/farmer register; cross-check with photo timestamps	-
3.4	Germination	Field count using fixed quadrat/row-length at 7–10 DAS; compute %	%
3.5	Weed count & dry weight using quadrat method	0.5×0.5 m (or 1×1 m) quadrat; count species; oven-dry at 65 °C to constant weight, type of weeds	g/m ²
3.6	Major insects	Weekly scouting on fixed plants/transects; sweep net/pheromone traps; count per area, ETL	no/m ²
3.7	Major diseases	Visual scoring on standard scales (0–9); incidence/severity from fixed plots,	no/m ²

		ETL	
3.8	Major nematodes	Soil/root sampling; Baermann funnel/modified Cobb's sieving; identification & count	no/m ²
3.9	Yield (main/by-product)	Crop-cutting on net plot (e.g., 5×5 m); thresh, dry to standard moisture; weigh	kg/ha
3.10	Method of irrigation	Field observation & records (flood/basin/furrow/sprinkler/drip)	-
3.11	Irrigation water applied	Inline water meter/Parshall flume & time-flow method; convert to depth (cm)	cm
Other details			
4.1	Rainfall	Standard/automatic rain gauge (AWS/IMD-spec); daily readings (mm)	mm
4.2	Rainfall distribution	Daily RG records aggregated to dekadal/monthly; hyetograph plotting	Rainy days
4.3	Temperature	Automatic Weather Station or max–min thermometers; daily T_max/T_min	°C
Economics			
5.1	Cost of cultivation	Enterprise budgeting from farm records; include imputed family labour	INR/ha
5.2	Gross/Net returns	Gross: yield × farm-gate price; Net: Gross – Cost of cultivation	INR/ha
5.3	B:C ratio	Benefit–Cost ratio = Gross returns / Cost of cultivation	-
5.4	Labour use	Daily labour sheets; convert to man-days per hectare	man-days/ha
5.5	Input cost reduction	Compare baseline vs current input costs; compute % reduction	%
Extreme conditions			
6.1	Flood	Incident log with GPS/photo; cross-	duration in days

		verify with IMD/State disaster reports	
6.2	Drought	Incident log; IMD rainfall anomaly; SPI/SPEI indices where available	duration in days
6.3	Hailstorm	Damage scoring on 0–10 scale; photo evidence; IMD nowcast records	0-10 scale
6.4	Others	Incident record with description, date, GPS/photo; verified with official sources	-
Others			
7.1	Mandatory upload (10 photos + 2 videos/season)	Capture via smartphone/digital camera; geotag; compress before upload	Kb
8.1	Above Ground: Seasonal	Record every crop season at key phenophase (sowing, vegetative, flowering, harvest)	-
8.2	Below Ground: Baseline & end of cropping year	Sample before start of interventions (baseline) and at end of each cropping year	-

Optional Data Sets

S. No.	Parameter	Method/Device	Unit
O1	Particulate Organic Carbon	Size fractionation (sieving/density) to isolate POC; TOC analyzer for C content	%
O2.1	Boron	Hot water extraction; quantify by Azomethine [®] H colorimetry or ICP [®] OES	mg/100g
O2.2	Zinc	DTPA (pH 7.3) extraction; AAS/ICP [®] OES	mg/100g

		determination	
O2.3	Iron	DTPA (pH 7.3) extraction; AAS/ICP-OES determination	mg/100g
O3	Soil Microbial Count	Serial dilution & pour/spread plating on appropriate media; CFU counting	CFU/g
O4.1	Dehydrogenase	TTC reduction to TPF; spectrophotometric measurement	-
O4.2	Phosphatase	p-Nitrophenyl phosphate assay; spectrophotometric measurement	-
O5	Soil microbiome/metagenomics	DNA extraction; 16S/18S rRNA amplicon sequencing; bioinformatics pipeline	16S/18S
O6	Microbial Biomass Carbon	Chloroform fumigation–extraction (Vance et al.) with KEC factor	mg/kg
O7.1	Brix	Handheld refractometer on fresh juice/extract	%
O7.2	Protein	Kjeldahl nitrogen × 6.25 (or NIR calibration where available)	%
O8	Oil	Soxhlet extraction (petroleum ether/hexane) or NMR/NIR methods	%

O9	Vitamin A	HPLC (retinol/ β -carotene quantification) after proper extraction	IU/100g
O10	Soil Arthropods	Pitfall traps/soil cores; Berlese funnel for litter extraction; count per area	No./m ²
O11	Arthropod biodiversity – mole cricket count	Fixed quadrat or pitfall traps along transects; identify and count	No./m ²
O12	Mycorrhizal Colonization	Root clearing & trypan blue staining; gridline intersect microscopy (Giovannetti & Mosse)	%