

# Omdena - Milan Chapter Agrifoods

## AI for Sustainable agri-food systems: use of Satellite Imagery

### Exploratory analysis of cereals production in Italy 2020-2022

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Here we have analysed the major areas and crops produced in Italy. Crop dataset used in this study was downloaded from the Italian National Institute of Statistics (Istat). The objective is to get some insights about crop production and its respective areas in Italy and how climate change have affected crop production in the last 3 years. Maps was created with dataset from Simone Rigoni, the address to the repository of the dataset i [aivaibe](#) in [References](#).

ITITER107	Territory	TIPO_DATOS	Data type	AGRI_MADRE	Type of crop	TIME	Select time	Value	Flag	Codes	Flags
0	ITC11	Torino	ART	total area - hectares	COMMEAT	common wheat	2020	2020	15362	NaN	NaN
1	ITC11	Torino	ART	total area - hectares	COMMEAT	common wheat	2021	2021	16831	NaN	NaN
2	ITC11	Torino	ART	total area - hectares	COMMEAT	common wheat	2022	2022	16735	NaN	NaN
3	ITC11	Torino	TP_QUIN_EXT	total production - quintals	COMMEAT	common wheat	2020	2020	844910	NaN	NaN
4	ITC11	Torino	TP_QUIN_EXT	total production - quintals	COMMEAT	common wheat	2021	2021	925705	NaN	NaN

## Pre-processing dataset

	Territory	Data type	Type of crop	Select time	Value
0	Torino	total area - hectares	common wheat	2020	15362
1	Torino	total area - hectares	common wheat	2021	16831
2	Torino	total area - hectares	common wheat	2022	16735
3	Torino	total production - quintals	common wheat	2020	844910
4	Torino	total production - quintals	common wheat	2021	925705
...	...	...	...	...	...
12125	Pesaro e Urbino	total area - hectares	rye and winter cereal mixtures (maslin)	2020	3
12126	Roma	total area - hectares	rye and winter cereal mixtures (maslin)	2022	20
12127	Valle d'Aosta / Vallée d'Aoste	total area - hectares	winter barley	2022	1
12128	Torino	total area - hectares	spring barley	2022	220
12129	Valle d'Aosta / Vallée d'Aoste	total area - hectares	oats and spring cereal mixtures (mixed grain o...	2022	3

12130 rows x 5 columns

DATASET SHAPE: (12130, 5)

```
-----
FEATURE DATA TYPES:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12130 entries, 0 to 12129
Data columns (total 5 columns):
#   Column      Non-Null Count  Dtype
---  -
0   City         12130 non-null   object
1   Data_type    12130 non-null   object
2   Type_crop    12130 non-null   object
3   Year         12130 non-null   int64
4   Value        12130 non-null   int64
dtypes: int64(2), object(3)
memory usage: 474.0+ KB
None

-----
NUMBER OF UNIQUE VALUES PER FEATURE:
City         107
Data_type     3
Type_crop    24
Year          3
Value       3103
dtype: int64

-----
NULL VALUES PER FEATURE
City         0
Data_type    0
Type_crop    0
Year         0
Value        0
dtype: int64
```

## Cities in Italy producing cereals

```
array(['Torino', 'Vercelli', 'Biella', 'Verbanio-Cusio-Ossola', 'Novara',
      'Cuneo', 'Asti', 'Alessandria', 'Valle d'Aosta / Vallée d'Aoste',
      'Savona', 'Genova', 'La Spezia', 'Varese', 'Como', 'Lecco',
      'Sondrio', 'Milano', 'Bergamo', 'Brescia', 'Pavia', 'Lodi',
      'Cremona', 'Mantova', 'Trentino Alto Adige / Südtirol', 'Verona',
      'Vicenza', 'Belluno', 'Treviso', 'Venezia', 'Padova', 'Rovigo',
      'Pordenone', 'Udine', 'Gorizia', 'Piacenza', 'Parma',
      'Reggio nell'Emilia', 'Modena', 'Bologna', 'Ferrara', 'Ravenna',
      'Forlì-Cesena', 'Rimini', 'Massa-Carrara', 'Lucca', 'Pistoia',
      'Firenze', 'Prato', 'Livorno', 'Pisa', 'Arezzo', 'Siena',
      'Grosseto', 'Perugia', 'Terni', 'Pesaro e Urbino', 'Ancona',
      'Macerata', 'Ascoli Piceno', 'Viterbo', 'Rieti', 'Roma', 'Latina',
      'Frosinone', 'Abruzzo', 'L'Aquila', 'Teramo', 'Pescara', 'Chieti',
      'Isernia', 'Campobasso', 'Caserta', 'Benevento', 'Avellino',
      'Salerno', 'Foggia', 'Bari', 'Taranto', 'Brindisi', 'Potenza',
      'Matera', 'Cosenza', 'Crotone', 'Catanzaro', 'Vibo Valentia',
      'Reggio di Calabria', 'Messina', 'Catania', 'Sassari', 'Nuoro',
      'Cagliari', 'Oristano', 'Lecca', 'Trapani', 'Palermo', 'Agrigento',
      'Caltanissetta', 'Siracusa', 'Ragusa', 'Napoli',
      'Monza e della Brianza', 'Fermo', 'Bartetta-Andria-Trani', 'Enna',
      'Sud Sardegna', 'Bolzano / Bozen', 'Imperia'], dtype=object)
```

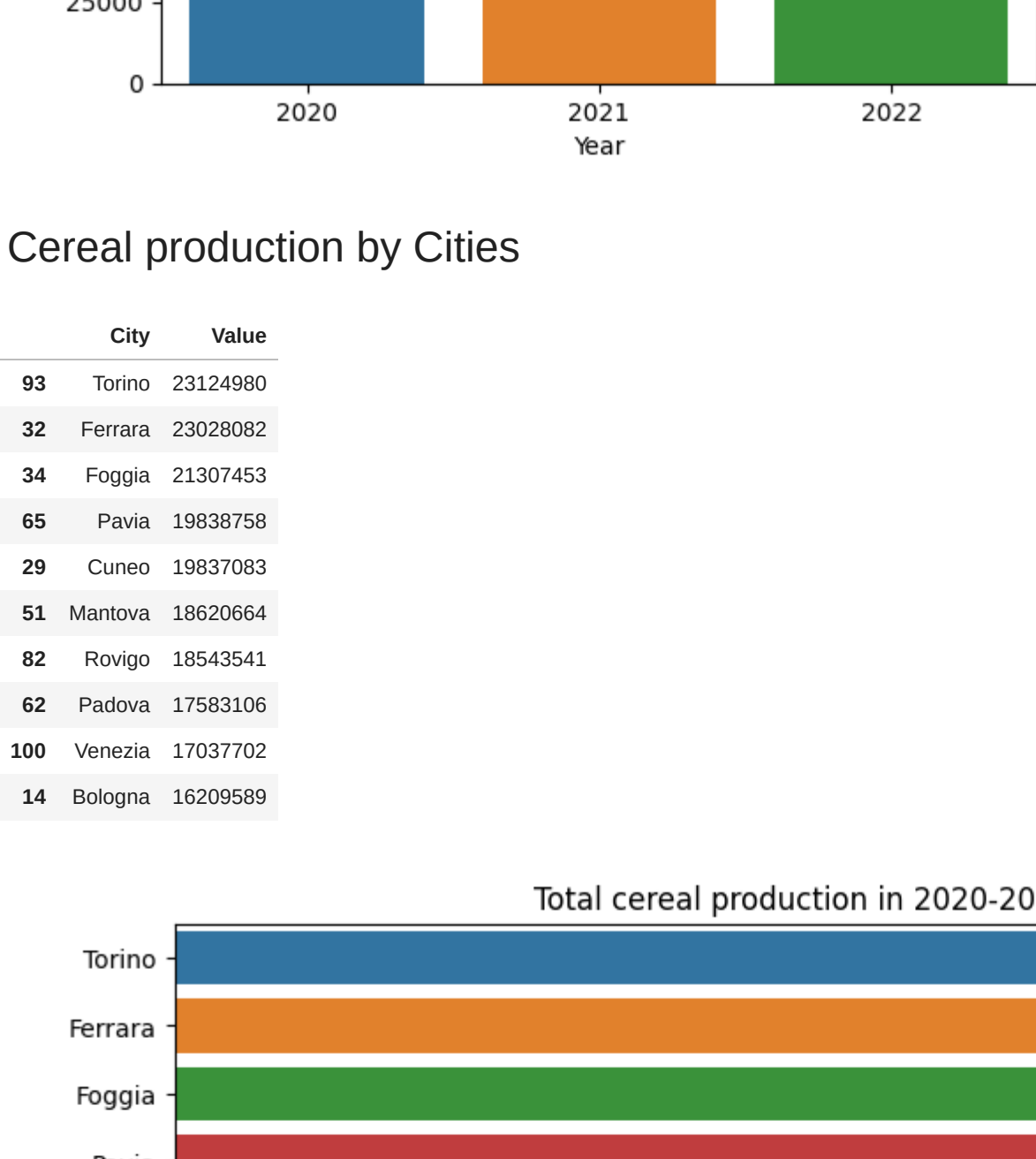
```
array(['total area - hectares', 'total production - quintals ',
      'harvested production - quintals '], dtype=object)
```

## Select only Values for harvested production - quintals

In general crop production is reported in tonnes per hectare, however Istat (<http://dati.istat.it>) does not give variables definition, so we have assumed that the column 'Value' for rows containing data for 'harvested production - quintals', are values for total harvested production of cereals.

City	Data_type	Type_crop	Year	Value
6	Torino	harvested production - quintals	common wheat	2020 844910
7	Torino	harvested production - quintals	common wheat	2021 925705
8	Torino	harvested production - quintals	common wheat	2022 836750
15	Vercelli	harvested production - quintals	common wheat	2020 64250
16	Vercelli	harvested production - quintals	common wheat	2021 74550

## Total cereal production in 2020-2022



## Cereal production by Cities

City	Value
93	Torino 23124980
32	Ferrara 23028082
34	Foggia 21307453
65	Pavia 19838758
29	Cuneo 19837083
51	Mantova 18620664
82	Rovigo 18543541
62	Padova 17583106
100	Venezia 17037702
14	Bologna 16209589



## Italy geographic areas is organized in regions, provinces or comunes.

The regions are classified as follow:

Sud/Mezzogiorno:

Abruzzo, Apulia/Puglia, Basilicata, Calabria, Campania, Molise, Sicily

- Abruzzo: L'Aquila, Pescara, Chieti, Teramo
- Apulia/Puglia: Foggia, Bari, Taranto, Brindisi, Lecce, Barletta-Andria-Trani
- Basilicata: Matera, Potenza
- Calabria: Crotone, Vibo, Valentia, Cosenza, Catanzaro, Reggio di Calabria
- Campania: Benevento, Caserta, Napoli, Avellino, Salerno
- Molise: Campobasso, Isernia
- Sicilia: Messina, Siracusa, Agrigento, Caltanissetta, Trapani, Enna, Palermo, Catania, Ragusa
- Sardegna: Oristano, Carbonia-Iglesias, Olbia-Tempio, Ogliastra, Medio Campidano, Sassari, Nuoro, Cagliari

Centro:

Toscana, Umbria, Marche, Lazio

- Toscana: Pistoia, Firenze, Massa-Carrara, Lucca, Arezzo, Livorno, Pisa, Grosseto, Siena, Prato
- Umbria: Perugia, Terni
- Marche: Ancona, Macerata, Ascoli Piceno, Pesaro e Urbino, Fermo
- Lazio: Roma, Viterbo, Rieti, Latina, Frosinone

Nord-ovest:

Piemonte, Valle d'Aosta, Lombardia, Liguria

- Liguria: Imperia, Savona, Genova, La Spezia
- Lombardia: Como, Varese, Milano, Pavia, Bergamo, Brescia, Sondrio, Cremona, Mantova, Monza e Della Brianza, Lecco, Lodi
- Piemonte: Vercelli, Novara, Torino, Cuneo, Asti, Alessandria, Biella, Verbanio-Cusio-Ossola
- Valdaosta: Valle d'Aosta

Nord-est:

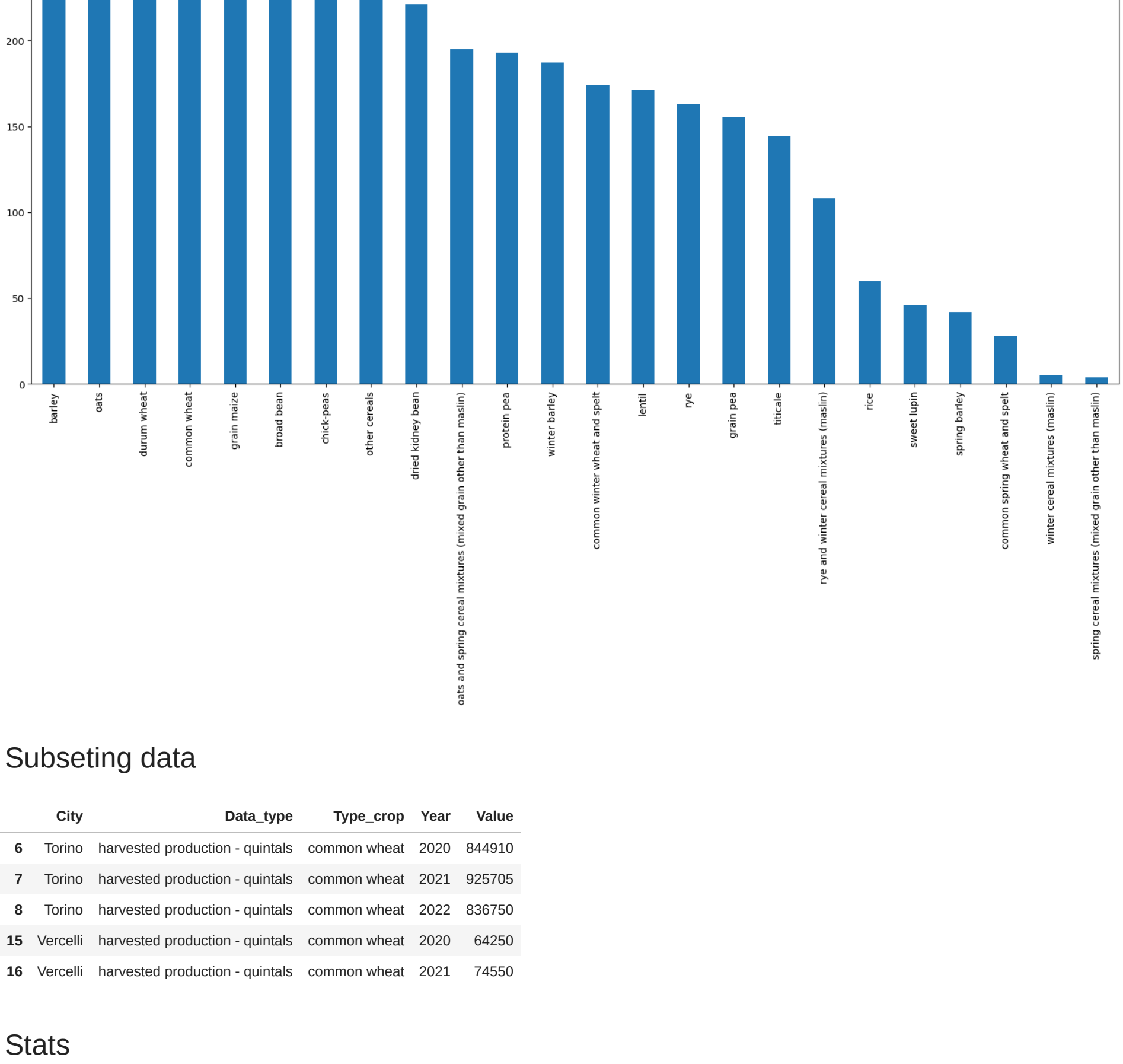
Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna

- Trentino: Bolzano/Bozen, Trento
- Veneto: Belluno, Verona, Vicenza, Rovigo, Treviso, Venezia, Padova
- Friuli: Udine, Gorizia, Trieste, Pordenone
- Emilia-Romagna: Parma, Reggio Nell'Emilia, Piacenza, Forlì-Cesena, Modena, Bologna, Ferrara, Ravenna, Rimini

## The most produced cereals 2020-2022

winter cereal mixtures (maslin)	300
oats	290
durum wheat	286
common wheat	284
grain maize	284
broad bean	241
chick-peas	235
other cereals	226
dried kidney bean	221
oats and spring cereal mixtures (mixed grain other than maslin)	195
protein pea	193
winter barley	187
common winter wheat and spelt	174
lentil	171
rye	163
grain pea	155
tititale	144
rye and winter cereal mixtures (maslin)	108
rice	69
sweet lupin	46
spring barley	42
common spring wheat and spelt	28
winter cereal mixtures (maslin)	5
spring cereal mixtures (mixed grain other than maslin)	4
Name: Type_crop, dtype: int64	

Dataset shows there are 24 different types of cereals cultivated in Italy. The top five most produced crops are Wheat, Barley, Maize, Beans and Oats.

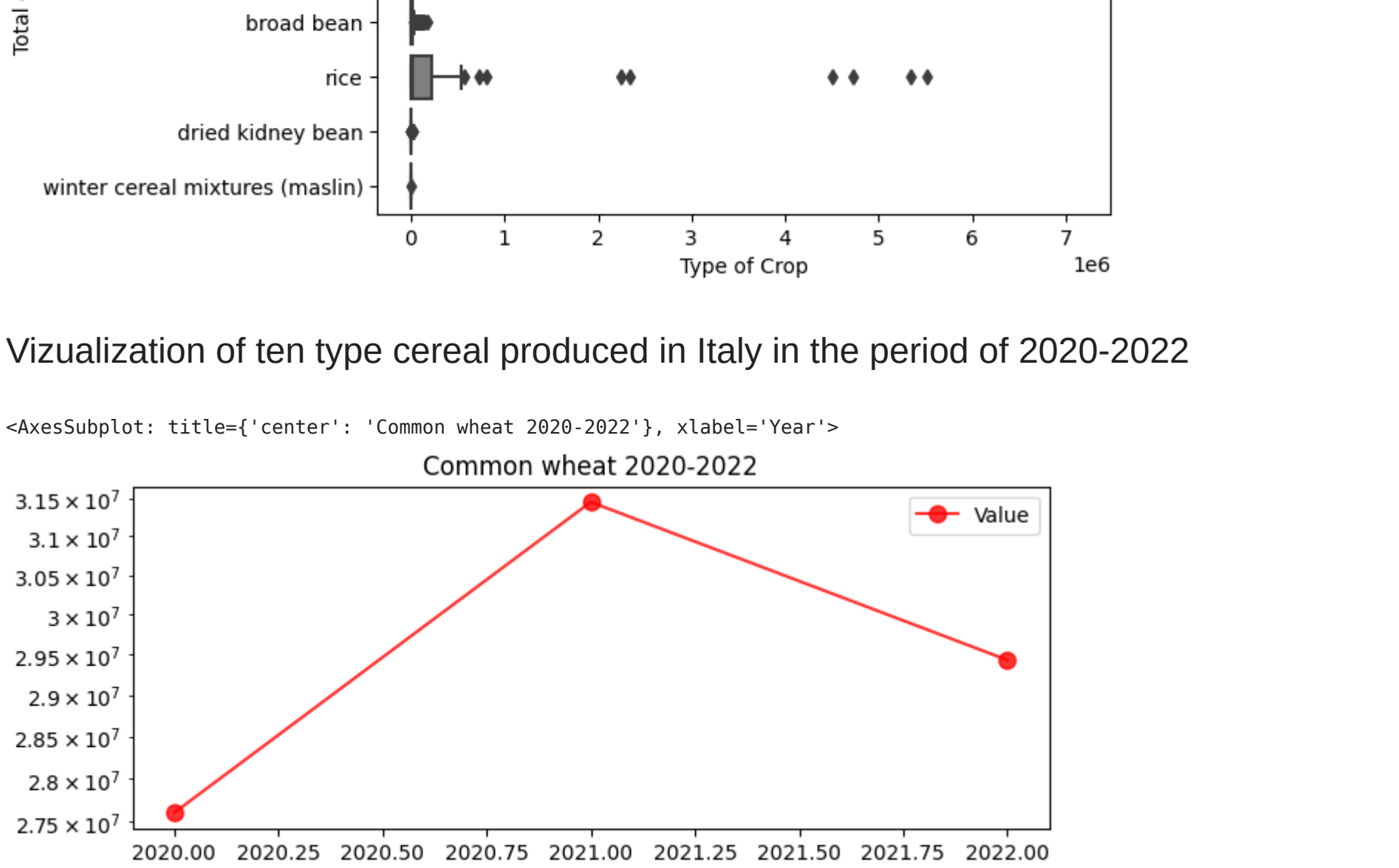


## Subsetting data

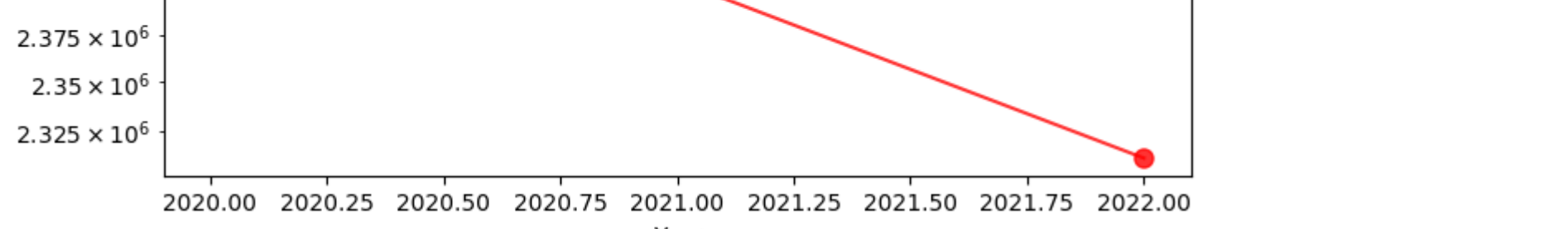
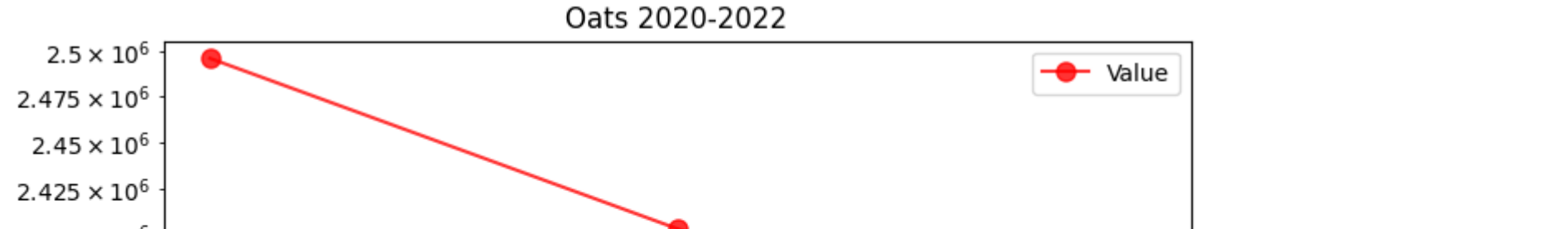
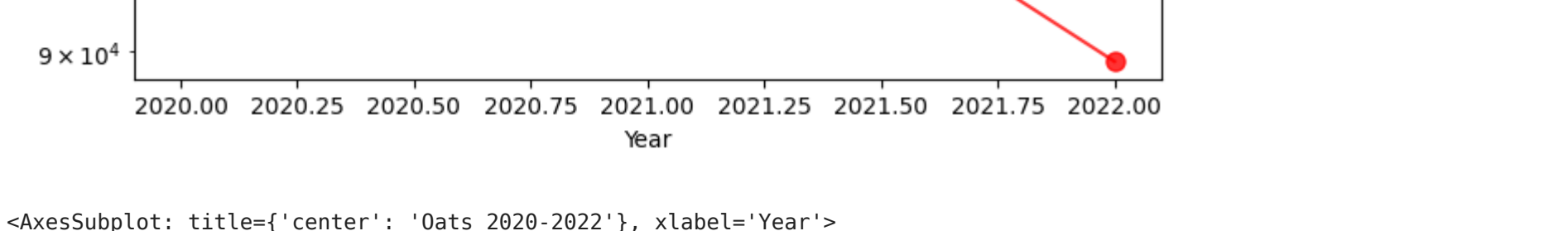
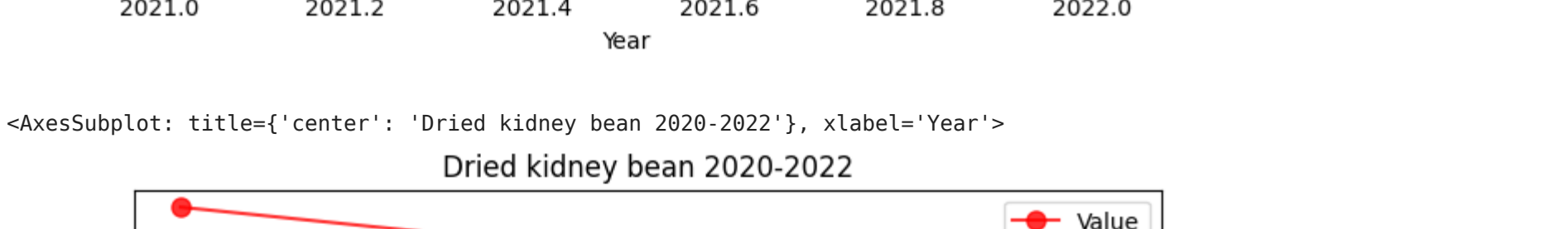
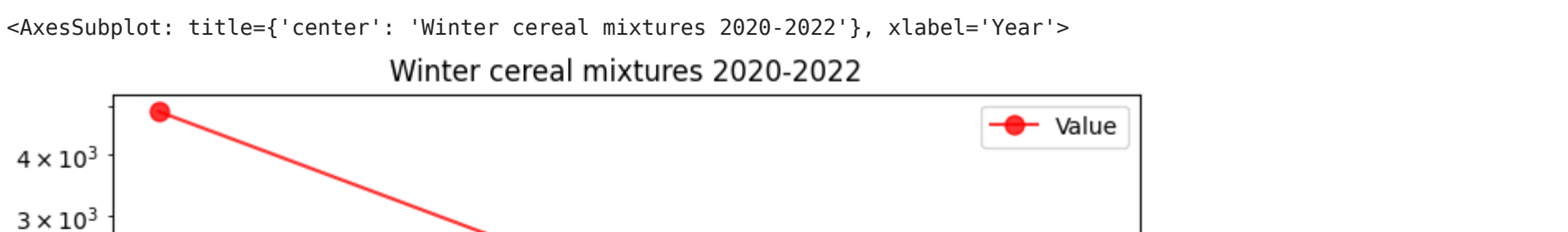
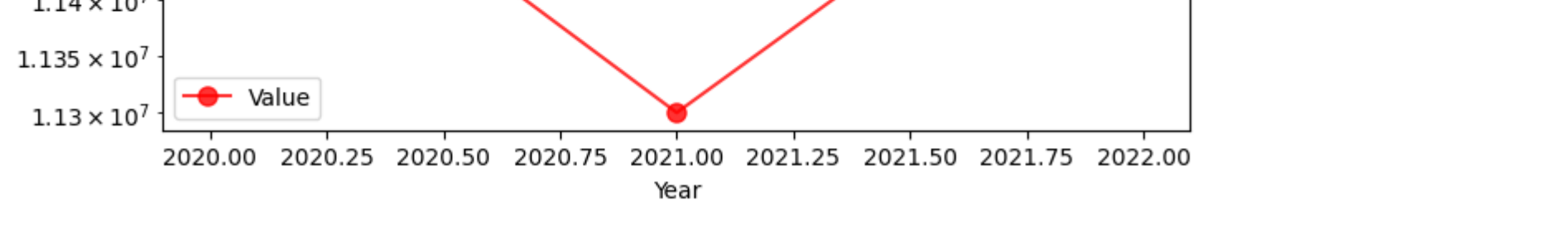
City	Data_type	Type_crop	Year	Value
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## Stats

Year	Value
count	2206
mean	2020 212859
std	0 611441
min	2020 0
25%	2020 1236
50%	2021 14150
75%	2022 120000
max	2022 7125000



## Visualzation of ten type cereal produced in Italy in the period of 2020-2022



• Rice is not in the top crop production

but it is an important crop, therefore I have included for further discussion in the group.



## References

- <http://dati.istat.it>
- <https://maps.princeton.edu/catalog/stanford-mn871sp9778>
- [https://www.crea.gov.it/documents/68457/0/ITACONTA+2020\\_ENG+DEF+xweb+%281%29.pdf/95c6b30a-1e18-8e94-d4ac-ce884aef76e8?t=1619527317576](https://www.crea.gov.it/documents/68457/0/ITACONTA+2020_ENG+DEF+xweb+%281%29.pdf/95c6b30a-1e18-8e94-d4ac-ce884aef76e8?t=1619527317576)