THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

CENTRAL STATISTICAL AGENCY

AGRICULTURAL SAMPLE SURVERY

2012/13 (2005 E.C) VOLUME VI

REPORT ON FARM MANAGEMENT PRACTICE BELG SEASON CROPS FOR

PRIVATE PEASANT HOLDINGS

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CHAPTER- I
1. INTRODUCTION AND OBJECTIVES OF THE SURVEY

1.1 Introduction

Country's experience showed that farmers' attitude and tendency to adopte and accept new innovations, modern agricultural techniques and technologies, such as use of fertilizers, irrigation, improved seeds and pesticides that help to improve their living standards through attaining enhanced productivity, do have positive impact on the development of the agricultural sector as a whole. In this regard, the extent of adopting modern agricultural practices, such as utilization of fertilizer, irrigation, pesticides and improved seeds …etc, by the peasant farmers often used as important indicators for estimating the rate and extent of modern technologies use in the country's agriculture, above all the magnitude and level modern/improved farm management practices in the agriculture sector used to be the sole indicater of the transformation rate of the country's existing agriculture to modern agriculture.

This report which is Volume VI of the seven series reports, presents quantitative information about the use of modern agricultural inputs for Belg season crops of 2012/13 (2005 E.C.) of the private peasant holdings for the country and regions as it was obtained from the results of the Belg Season Crop Production Sample Survey conducted in May, 2013 by the Central Statistical Agency (CSA).

1.2 Objectives of the 2012/13 (2005 E.C) Belg Season Crop Production Sample Survey

The objectives of the 2012/13 (2005 E.C.), Belg Season Crop Production Sample Survey is to produce basic quantitative information on cropland area, production and yield, of major Belg season crops, as well as to provide quantitative information on:-

- The extent and use of different farm management practices on Belg season crops such as fertilized crop land area and quantity of fertilizer used by crop and fertilizer type, irrigated cropland area under improved seed, pesticide treated cropland area ….. etc.
- The adequate and timely supply of this information to ultimate users is, therefore, important for use as a primary input in the process of policy formulation, designing developmental agricultural projects and programmmes. This report, therefore, presents quantitative information on the above mentioned major variables at country and regional levels.

CHAPTER II

2. SURVEY METHODOLOGY, FIELD ORGANIZATION, METHOD OF DATA COLLECTION AND PROCESSING

2.1 COVERAGE

The 2012/13 (2005 E.C) Annual Agricultural Sample Survey (Belg season) covered the entire rural parts of the country except the non-sedentary population of three zones of Afar & six zones of Somali regions. Accordingly the survey took in to account of all parts of Harari, Dire Dawa, and actually **60** Zones / Special weredas (that are treated as zones) of other regions.

To be covered by the survey, a total of around **1,440** Enumeration Areas (EAs) were selected. However, due to various reasons that are beyond control, in **212** EAs the survey could not be successful and hence interrupted. Thus, all in all the survey succeeded to cover **1,228** EAs throughout the regions. The Annual Agricultural Sample survey (Belg season) was conducted on the basis of 30 agricultural households selected from each EA.

2.2 SAMPLING FRAME

The list containing EAs of all regions and their respective households obtained from the 2007 (1999 E.C) cartographic census frame was used as the sampling frame in order to select the primary sampling units (EAs). Consequently, all sample EAs were selected from this frame based on the design proposed for the survey. The second stage sampling units, households, were selected from a fresh list of households that were prepared for each EA at the beginning of the survey.

2.3 SAMPLE DESIGN

In order to select the sample a stratified two-stage cluster sample design was implemented. Enumeration areas (EAs) were taken to be the primary sampling units (PSUs) and the secondary sampling units (SSUs) were agricultural households.

The sample size for the 2012/13(2005 E.C) agricultural sample survey was determined by taking into account of both the required level of precision for the most important estimates within each domain and the amount of resources allocated to the survey. In order to reduce

non-sampling errors, manageability of the survey in terms of quality and operational control was also considered.

Except Harari, and Dire Dawa, where each region as a whole was taken to be the domain of estimation; each zone of a region / special wereda was adopted as a stratum for which major findings of the survey are reported.

2.3 SELECTION SCHEME

Enumeration areas from each stratum were selected systematically using probability proportional to size sampling technique; size being number of agricultural households. The sizes for EAs were obtained from the 2007 (1999 E.C) cartographic census frame. From the fresh list of households prepared at the beginning of the survey 30 agricultural households within each sample EA were selected systematically. Estimation procedure of totals, ratios, sampling error and the measurement of precision of estimates (CV) and the questionnaires are given in Appendix-I, Appendix- II and Appendix-III respectively.

2.5 Field Organization

The Central Statistical Agency (CSA) branch statistical office heads, field supervisors and enumerators, other supporting staff and drivers were all involved in the field operation activities of the 2012/13 (2005 E.C.) Belg season Crop Production Sample survey. To accomplish the data collection activities, all field enumerators were equipped with the necessary survey equipment (i.e. compass, programmable calculator, measuring tape, sample bags…etc). To assist with the fieldwork and data collection activities all available four-wheel drive vehicles were used for supervision and collection of completed questionnaires.

2.6 Training of Field Staff

At the beginning of the survey year, the field staff-training program was carried out in two stages. The first stage consisted of trainees from the head office, branch statistical office heads, statisticians and some of the field supervisors for one week at Bahirdar, the city of Amhara national state. Those trained in the first stage conducted similar training for field supervisors and enumerators for 20 days in the 24 branch statistical offices, which are distributed all over the country. During the second stage training, the field staff were given detailed classroom instruction on the objectives and uses of the Agricultural Sample Survey (AgSS), concepts, and definitions of terms used, the method of area measurement, interviewing procedures, … etc. The enumerators' and supervisors' training also included a field practice to reinforce the

procedures discussed in the classroom with regard to field area measurement, use of the programmable calculator, GPS/Compass Rope and crop-cutting techniques.

2.7 Methods of Data Collection.

Except cropland area of Major Belg Season crop, the data of which collected objectively using GPS/compasses and measuring tape, the information on production of major Belg Season crops and agricultural practices (uses of fertilizer, pesticide, improved seed and irrigation) were subjectively collected by interviewing the holders of sampled households.

A major characteristic of Ethiopian agriculture is the existance of two well-known crop production seasons referred to as the Meher (or main) and belg (short rain) Seasons. The generally accepted definition of the Meher season is that of the long rainy season, which normally occurs from June to September. The Belg Season most often refers to small but timely rainy season, which normally occurs from February to May but in limited areas of the country. Generally, the Meher Season rainy period provides ideal growing conditions for the longer maturing crops. Planting and harvest of Meher crops can extend to December or January in some areas. Most of the time holders rely on short maturing crops for planting during the Belg rainy period and harvest of the crops is in June or July.

A point of contention arises with respect to the pure definition of the Belg crop. Belg cropping practices are heterogeneous across different portions of the country. The nature of the sowing period also overlaps with some of the Meher Season crops. Consequently, the report on Belg Season crops in the past faced a problem of a clearly defined growing period. It is important not to overlook or miss agricultural practices performed all year round due to use of irrigation or soil moisture from sufficiently dried areas that from time-to-time are swampy or marshy. To help clarify the two-crop season, the following definition has been in use since 1987/88:

Belg Season Crops were defined as any crops that are harvested during the months of March to August, while those crops that are harvested during September to February are considered Meher (or main) season crops.

This report consists of estimates of area, production and yield of major Belg Season crops for the year 2012/13 (2005 E.C.) The data collection period for obtaining the area, production and agricultural practices of the Belg season crops was from ‘Sene’ 1 -15, 2005 E.C. (i.e. From June 8 to June 22, 2013). Data on area under Belg season crop are collected objectively using

compass and measuring tapes, while data on production of belg season crops were using subjective method based on face-to-face interviewing of the holder by the enumerator. Data on production of belg season crops are calculated from the condition factor data that are collected directly from the sampled holders within household, peasant association chairpersons and development agents. The enumerators were trained to systematically present the questions to the respondents on percentage changes translating to languges.

2.8 Data Processing

a. Editing, Coding and Verification

To insure the quality of the collected survey data an editing, coding, and verification instruction manual was written, and thirty four editors, data coders and verifiers were trained for one day to edit, code and verify the data using the aforementioned manual as a reference and teaching aid.

The enumerator completed edited and coded questionnaires sent to the head office were thoroughly verified by trained verifiers on a 100% basis before the questionnaires were sent to the data entry unit. The editing, coding, verification and data entry of all questionnaires was completed in two weeks time.

b. Data Entry, Cleaning and Tabulation

Before starting data entry computer edit specifications were prepared for use on personal computers, utilizing the CSPRO Software for data consistency checking purposes. The data on the coded questionnaires were then entered into the CSPRO software on personal computers. The data was then checked and cleaned using the computer edit specifications prepared earlier for this purpose. Forty six data encoders and eight supervisors were involved in the process and it took twenty five days to complete the job. Finally, tabulation was done on personal computers to produce results as indicated in the tabulation plan.

2.9 Basic concepts and definitions

For better understanding and ultimate use of the data presented in this report, the definitions and concepts of technical terms and terminologies used for the collection of all types of data of the 2012/13 (2005 E.C.) Belg Seasons Crop Production Sample Survey is presented below: -

Enumeration Area (EA): An Enumeration Area in rural parts of the Country is a locality that is less than or equal to a farmer's association area and usually it consists of 150-200 households.

Household:- A household may be either;

a) a one person household, that is a person who makes provision for his own food or other essentials for living without combining with any other person to form part of a multi person household or
b) a multi person household, that is, a group of two or more persons who live together and make common provision for food or other essentials for living. The persons in the group may pool their incomes and have a common budget to greater or lesser extent. They may be related unrelated persons, or a combination of both.

Agricultural Household:- A household is considered an agricultural household when at least one member of the household is engaged in growing crops and/or breeding and raising livestock in private or in partnership with others.

Holder:- A holder is a person who exercises management control over the operations of the agricultural holding and takes the major decision regarding the utilization of the available resources. He has technical and economic responsibility for the holding. He may operate the holding directly as an owner or as a manager.

Under conditions of traditional agricultural holding the holder may be regarded as the person, who with or without helps, of others, operates land or raises livestock in his own right, i.e. the person who decides on what, when where and how to grow crops or raise livestock and has right to determine the utilization of the products.

Holding: - A holding is all the land and livestock kept which is used wholly or partly for agricultural production and is operated as one technical unit by one person alone, or with others, without regard to title, legal form, size or location.

Parcel: - A parcel of holding is any piece of land entirely surrounded by land, water, road, forest, etc. which is not part of the holding. It may consist of one or more cadastral units, plots or field adjacent to each other.

Field: - A field is defined as any plot of land, which is a parcel or part of a parcel under the single mixed crop.

Belg Season Crops: - are defined as any crops that are harvested during the months of March (Megabit) to August (Nehase).

Meher Season Crops: - are those crops that are harvested during September (Meskerem) to February (Yekatit) are considered as main (Meher) season crops.

Irrigated area: - refers to the area of land purposely and actually provided with water, other than by rain, for improving the production of crops. The uncontrolled flooding of land by the over flow of rivers or streams is not categorized as irrigation practice although sometimes farmers use this incidence for production.

Improved Seed: is defined as crop variety, which gives significantly higher yield, better quality and/or better benefit compared to traditional varieties of seeds, and usually produced by the Ethiopian Seed Enterprise (ESE) in Ethiopia.

Fertilizer: - refers to anything added to the soil intended to increase the amount of plant nutrients available for crop growth. Usually fertilizers are divided into two parts, Natural and commercial. Examples of natural fertilizers are farmyard manure and wood ashes while commercial fertilizers are DAP (Di-Ammonium phosphate) and UREA (Ammonium Nitrate).

Pesticides: Pesticides are chemicals useful for the mitigation, control or elimination of pests which are troublesome or harmful to crop. Insecticides, herbicides and fungicides are all considered as pesticides.

CHAPTER III

III. SUMMARY OF THE RESULTS OF THE 2012/13 (2005 E.C.) FARM MANAGEMENT PRACTICES OF BELG SEASON SURVEY

In this part of the report, the results of the 2012/13 (2005 E.C.), Belg Season Crop Production Sample Survey on the extent and use of Belg season farm management practices are presented. The following are brief desscusions on the major findings of the survey.

According to 2012/13 (2005 E.C.), Belg Season Crop Production Sample Survey results, it was estimated that Belg season all crops covered 1,396,472 hectares of land, where 6,371,743 holders were engaged in the production activity. Of this total area under Belg season crops 1,031,024 hectares (73.83%) was under the use of improved farm management practices in which 6,695,091 agricultural holders reported for utilizing different agricultural inputs. Moreover, in 2012/13 (2005 E.C.) it was estimated that a total of 396,705 quintals of commercial fertilizer was utilized for Belg season crop production.

Summary Table A: Total Cropland Area and Number of holders engaged in 2010/11 (2003 E.C.) belg season crop production activities

• **Belg crop Area in Hectare**	**1,396,472**
• **Number of Belg Crop Producing Holders**	**6,371,743**
• **Improved Farm Management including practices in Hectare**	**1,031,024**
• **Number of holders reporting the use of farm management practices**	**6,695,091**
• **Quantity of commercial fertilizer applied in Quintals**	**396,705**

3.1 Belg Season Cropland Areas **under Different Farm Management Practices**

According to the 2012/13 (2005 E.C.), Belg season Crop Production Sample Survey results, it was estimated that Belg season crops covered about 1,396,472 hectares of land. Of this total, about 1,031,024 hectares (73.83%) was under the use of improved farm management practices. Moreover, of the above mentioned total cropland area under improved farm inputs, about 575,222 hectares (41.19%) was under fertilizer (Both Natural and Commercial), 92,211 hectares (6.60%) was under irrigation, 156,028 hectares (11.17%) was treated with pesticides

and 39,914 hectares (2.86%) was under improved seeds. The coverage of the above mentioned farm management practices accounted

Summary Table B. Cropland Area Under Improved Farm Management Practices;
For Private Holdings, 2012/13 (2005 E.C.), Belg season
Country Level

Farm Mangement Practices	Cropland AREA		% From Country Total
	IN Hectare	%	
IRRIGATION	92,211	10.68	6.60
IMPROVED SEEDS	39,914	4.62	2.86
FERTILIZER	575,222	66.62	41.19
PESTICIDES	156,028	18.07	11.17
TOTAL	863,375	100.00	61.82

for 41.19%, 6.60%, 11.17% and 2.86% of the country level total area under Belg season crops, respectively (See Summary Table B).

In Summary Table C, below the 2012/13 (2005 E.C.), Belg Season estimates of total cropland area under different farm management practices is presented. As it is indicated in the summary Table, the highest proportion of cropland area under different farm management practices was reported to be covered by Cereals, which accounted for 858,382 hectares (68.63 %) from the total all crop land covered area reported at country level), followed by pulses with 256,946 hectares (18.40%) from the total all cropped land area reported at country level under improved farm management practices,The other crops i.e. Root crop, vegetable and Oilseed are covers 137,962 hectar(9.88%), 27,740 hectar (1.99%) and 15,443 hectar (1.11%) respectively**.**

Summary Table C. Cropland Area Under Improved Farm Management Practices;
For Private Holdings, 2012/13 (2005 E.C.), Belg season
Country Level

Crop Cattegory	Cropland AREA			
	Total Area		Under IMP. Farm Mgmnt Practice	
	Area In Hectare	%	Area In Hectare	% From Total
CEREALS	958,382	68.63	711,103	68.97
PULSES	256,946	18.40	134,755	13.07
OIL CROPS	15,443	1.11	6,198	0.60
VEGTABLES	27,740	1.99	24,665	2.39
ROOT CROPS	137,962	9.88	154,291	14.97
ALLCROPLAND AREA	1,396,472	100	1,031,012	100

3.2 Fertilizer Applied Cropland Area and Fertilizer Type used

The results of the survey indicate that belg season cropland area under both natural and commercial fertilizers were estimated to be 575,222 hectares, covering (41.19%) of the total area under Belg seasons crops of the private holdings. Of the total fertilized area 262,353 hectares (45.61% from the total fertilizer appliedbel cropland area and 18.79% from total country level Belg Cropland area) was reported to be under natural fertilizers. The coverage of commercial fertilizers was estimated to be 312,869 hectares (54.39 % from the total fertilizer applied aea and 22.40% from the country total crop land areat), the share of DAP, UREA and the mixture of the two [i.e. DAP + UREA] called as commercial fertiltzers altogether constitute 44.29%, 3.54% and 6.56% of the total fertilizer applied crop land area and 18.24%, 1.46% and 2.71% of the total country level reported Belg season cropland area in that order (For details see Summary Table D.)

Summary Table D:- Fertilizer Applied Cropland Area ;For Private Holdings,
2012/13 (2005 E.C.), Belg season

Country Level

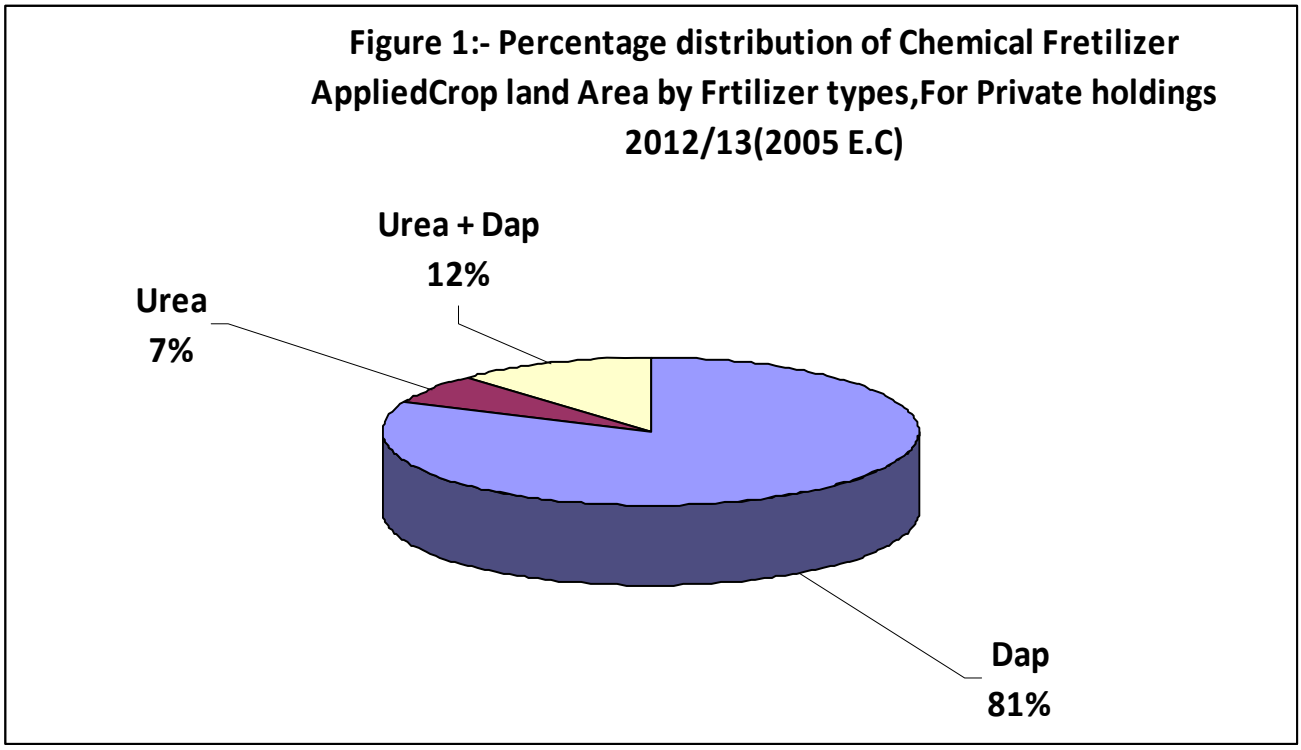
FertilizerType	Fertilizer Applied AREA		% From Country Total B.Crop Area
	In Hectare	%	
Natural	**262,353**	**45.61**	**18.79**
Commercial	**312,869**	**54.39**	**22.40**
DAP	**254,757**	**44.29**	**18.24**
UREA	**20,371**	**3.54**	**1.46**
DAP + UREA	**37,741**	**6.54**	**2.70**
Total	**575,222**	**100.00**	**41.19**

3.3.1 Use of Natural Fertilizers

In general, the application of natural fertilizers for Belg season crops in 2012/13 (2005 E.C.), varies from crop to crop. Of the total area under natural fertilizer, the highest proportion was reported for maize crop, which was estimated at 110,830 hectares (42.24%). The fertilized area (natural fertilizer) under haricot beans was the second with an estimated area of 41,892 hectares (15.97%), while area under potato stood third i.e. 36,058 hectares, accounting 13.74% of the total country level natural fertilizer applied Belg season cropland area (see Table 2.1).

3.3.2 Use of Commercial Fertilizers

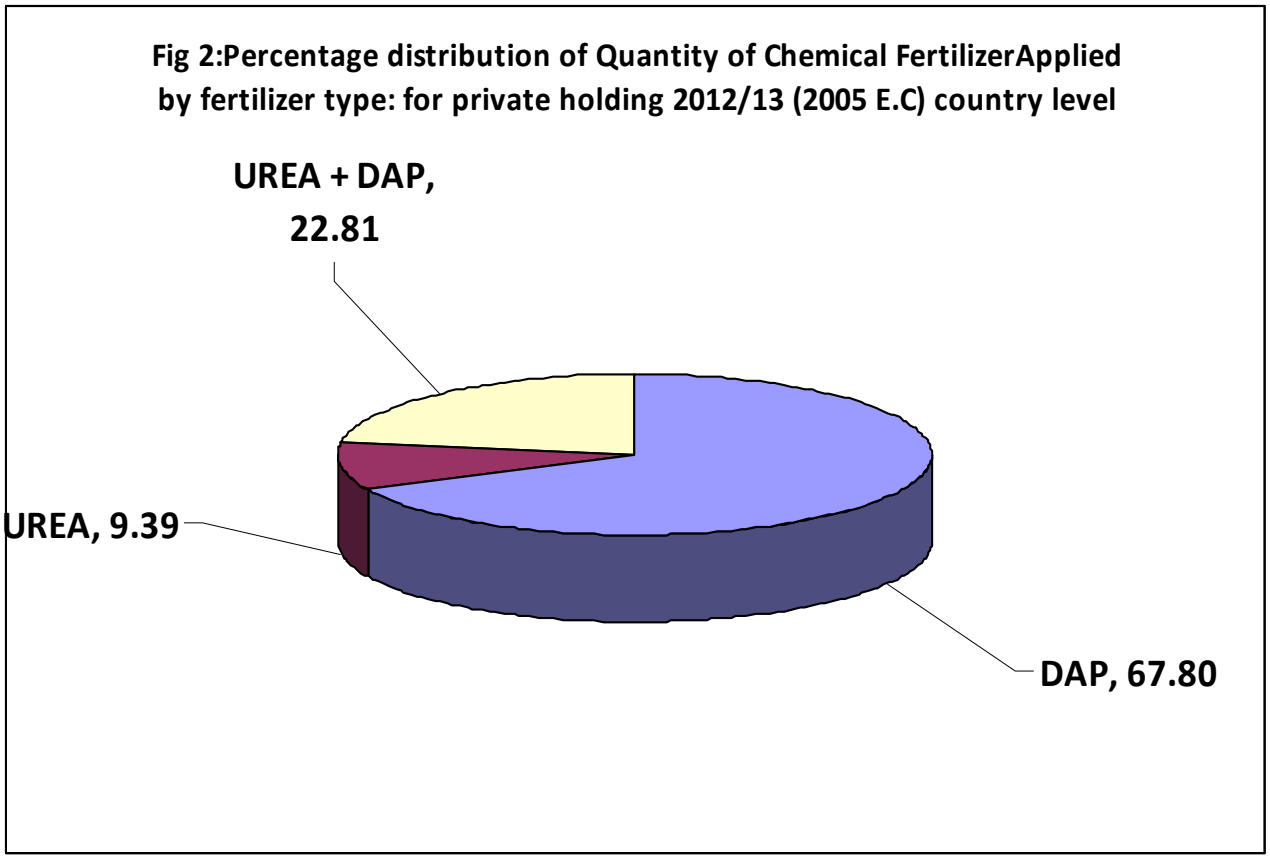
Out of the total cropland area under commercial fertilizers in 2012/13 (2005 E.C.), Belg season, i.e, 312,869 hectare (54.39%) of the total Belg season crop area), the area under DAP was the highest which accounted for 254,757 hectare (81.43%), while the the second and third were the mix of the two fertilizers (DAP+UREA) and UREA covering 37,741 hectare (12.06%) and 20,371 hectare (6.51 %) of the total commercial fertilizer applied area, respectively (see Fig 1.)



Similarly, the application of commercial fertilizers varied from crop to crop. Of the total area under commercial fertilizers, the highest area was reported for Maize at 87,753 hectares (28.05%). The second highest area reported under commercial fertilizers was for Haricotbean, i.e., 48,961 hectares (15.65%), followed by potato with 49,610.hectares, i.e. about 15.86% of the total haricotbean coverd area, was under commercial fertilizer, during the 2012/13 Belg season harvest.

The regional distribution of both natural and commercial fertilizers application varied from region to region. For instance, of the total area under both (Natural + Commercial) fertilizers, the highest was reported for Oromia Region, which accounted for 298,680 hectares (51.92%) of the total country level both Natural + Commercial fertilizer applied cropland area), S.N.N.P and Amhara Regions were the second and third in contributing the highest both (Natural and

Commercial) fertilizers applied cropland area which were estimated to be **210,205** hectares (36.54**%)** and **62,556** hectares (**10.88%),** respectively.



3.4 Type and Quantity of Commercial Fertilizer Applied

In 2012/13 (2005 E.C.) the total quantity of commercial fertilizer used for Belg season crop production was estimated at 396,705 quintals. Of this total, the share of DAP was the highest accounting for 67.78% (268,965 quintals). The mixture of the two types of fertilizers (DAP+UREA) was the second highest accounting for 22.81% (90,488 quintals). The last was the share of the Urea, which accounted for 9.39% (37,252 quintals) (See Fig 2).

3.5 Number of Belg Crop producing HoldersRreporting use of Improved Farm Management Practices by Age

To easily identify the age category of holders who used to earn the economic benefit generated from adopting/practicing the use of modern farm management practices on their holdings, Belg crop producing holders' ages have been categorized into nine groups. These are:

The group categories by age

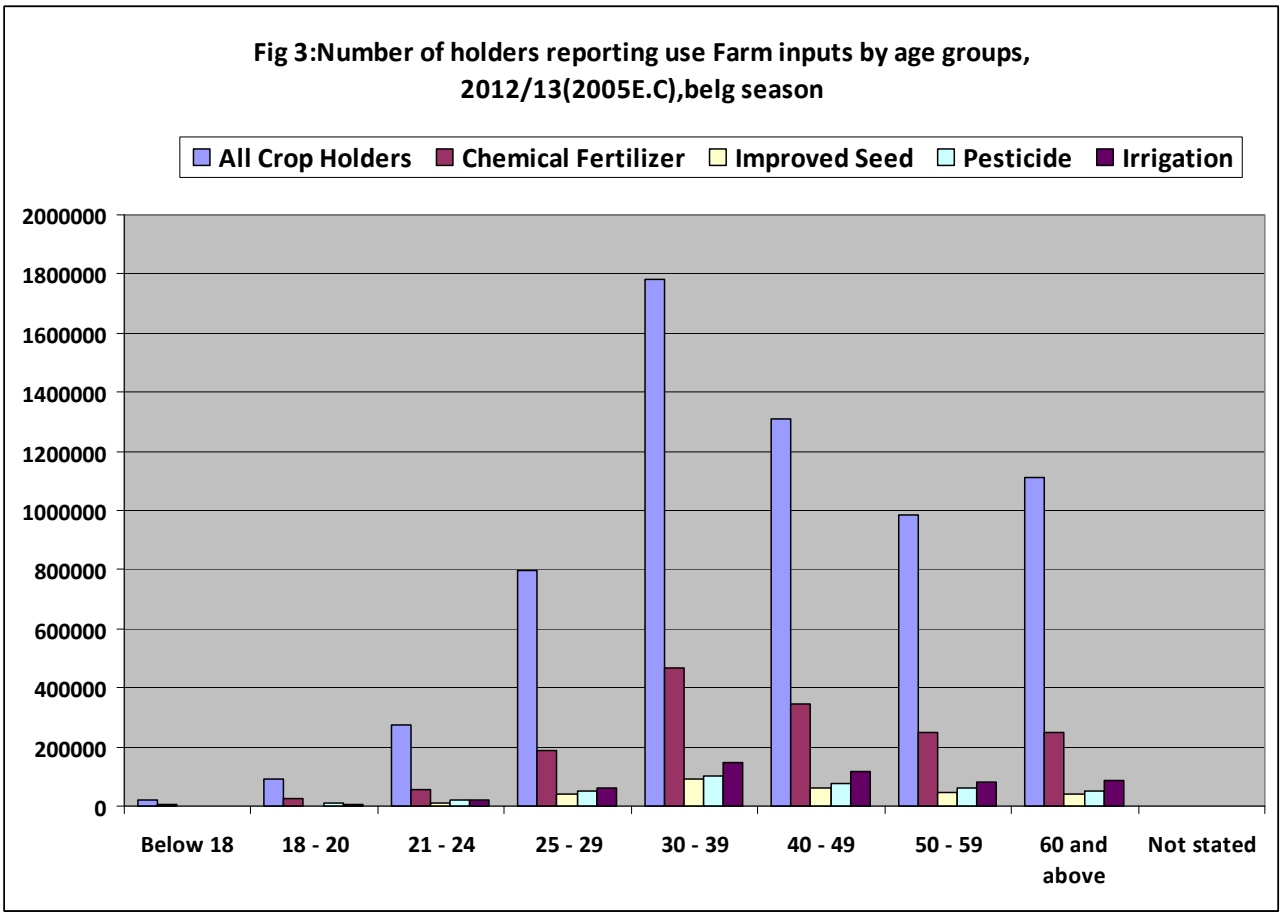
Group	1	-	Under 18 Years
Group	2	-	18-20 Years
Group	3	-	21-24 Years
Group	4	-	25-29 Years
Group	5	-	30-39 Years
Group	6	-	40-49 Years
Group	7	-	50-59 Years
Group	8	-	60 years& above
Group	9	-	not stated

Based on the survey results, a total of 6,371,743 holders were engaged in the over all Belg season agricultural activities in 2012/13 (2005 E.C.) belg season. As mentioned above, these holders are categorized in to nine age groups based on the age of the holder. Accordingly, the highest number 1,782,605 (27.98%) of holders was estimated to fall in the age group 30-39. The second 1,310,873 (20.57%) and third 1,109,498 (17.41%) highest number of holders fall in the age groups 40-49 and 60 and above, respectively. Moreover, it was estimated that a total of

Summery table E: Number and Percentage distribution of Belg Crop producing Holders reporting use of Farm inputs by age group; for private holdings 2012/2013 (2005 E.C) belg season Country Level

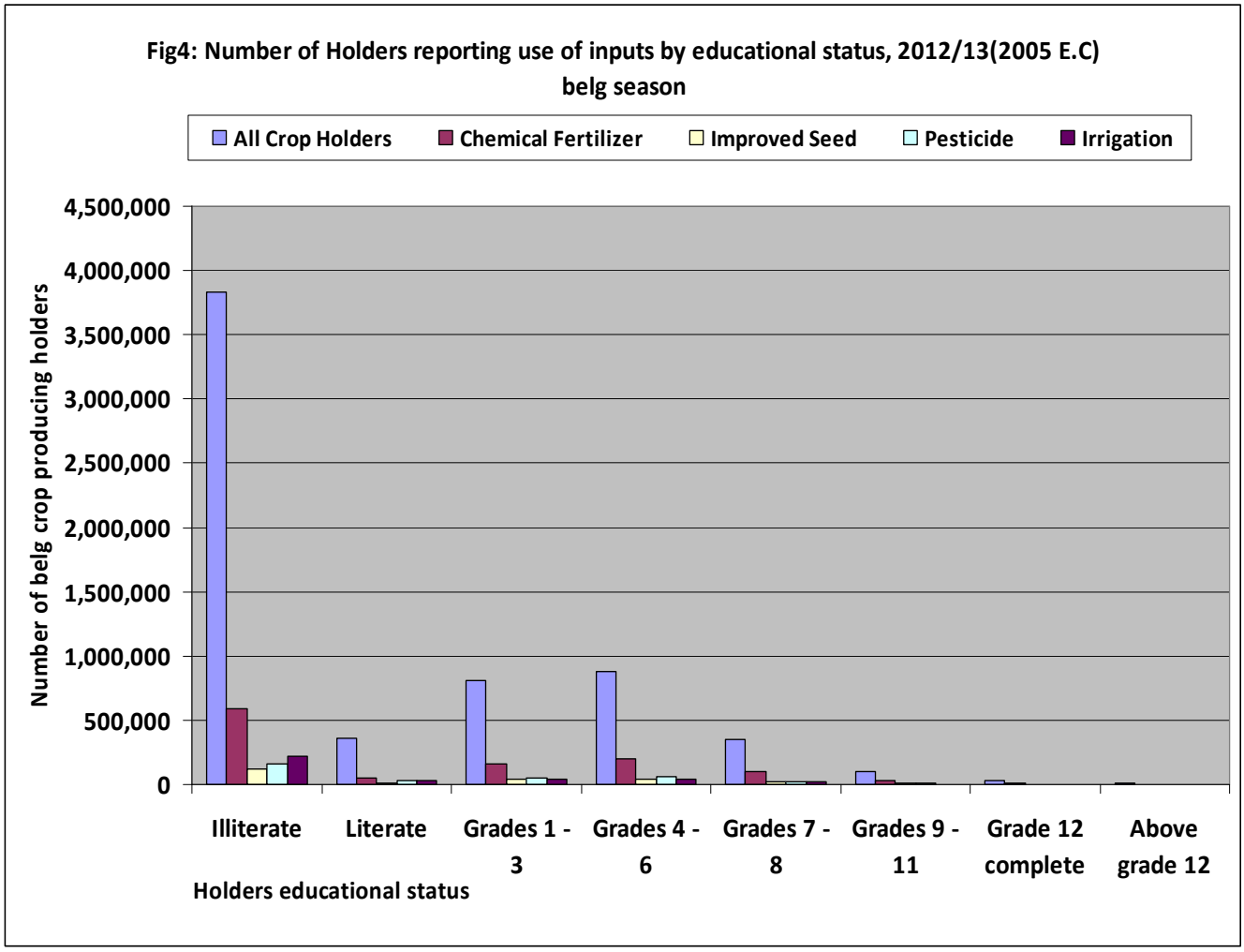
Age group	*All Crop Holders*	*%*	*Chemical Fertilizer*	*%*	*Improved Seed*	*%*	*Pesticide*	*%*	*Irrigation*	*%*
Below 18	22676	0.36	4220	0.27	*		1897	0.51	*	
18 - 20	91868	1.44	25888	1.63	1498	0.51	8082	2.15	3457	0.67
21 - 24	273202	4.29	57007	3.59	11137	3.81	18931	5.04	22625	4.38
25 - 29	794448	12.47	189602	11.94	38289	13.09	53034	14.12	58732	11.37
30 - 39	1782605	27.98	468852	29.53	91082	31.14	103411	27.54	148873	28.82
40 - 49	1310873	20.57	344111	21.68	60268	20.60	77233	20.57	115759	22.41
50 - 59	985835	15.47	249230	15.70	46766	15.99	60226	16.04	79033	15.30
60 and above	1109498	17.41	247932	15.62	42703	14.60	51918	13.83	86535	16.75
Not stated	*									
Total	6371743	100	1587581	100	292528	100	375470	100	516499	100.00
%	***100***		24.92		4.59		5.89		8.10	

1,587,581; 292,528; 375,470 and **516,499** Belg crop-producing holders (i.e. about **24.92%; 4.59%; 5.89**% and **8.10**% of the country total Belg crop producing holders) reported the use of Chemical fertilizer, pesticides, improved seed, and irrigation practices, respectively, to obtain higher cop yield (See summary Table E).



3.6 Number of Belg Crop producing Holders reporting use of Improved Farm Management Practices, by Holders' Educational Status

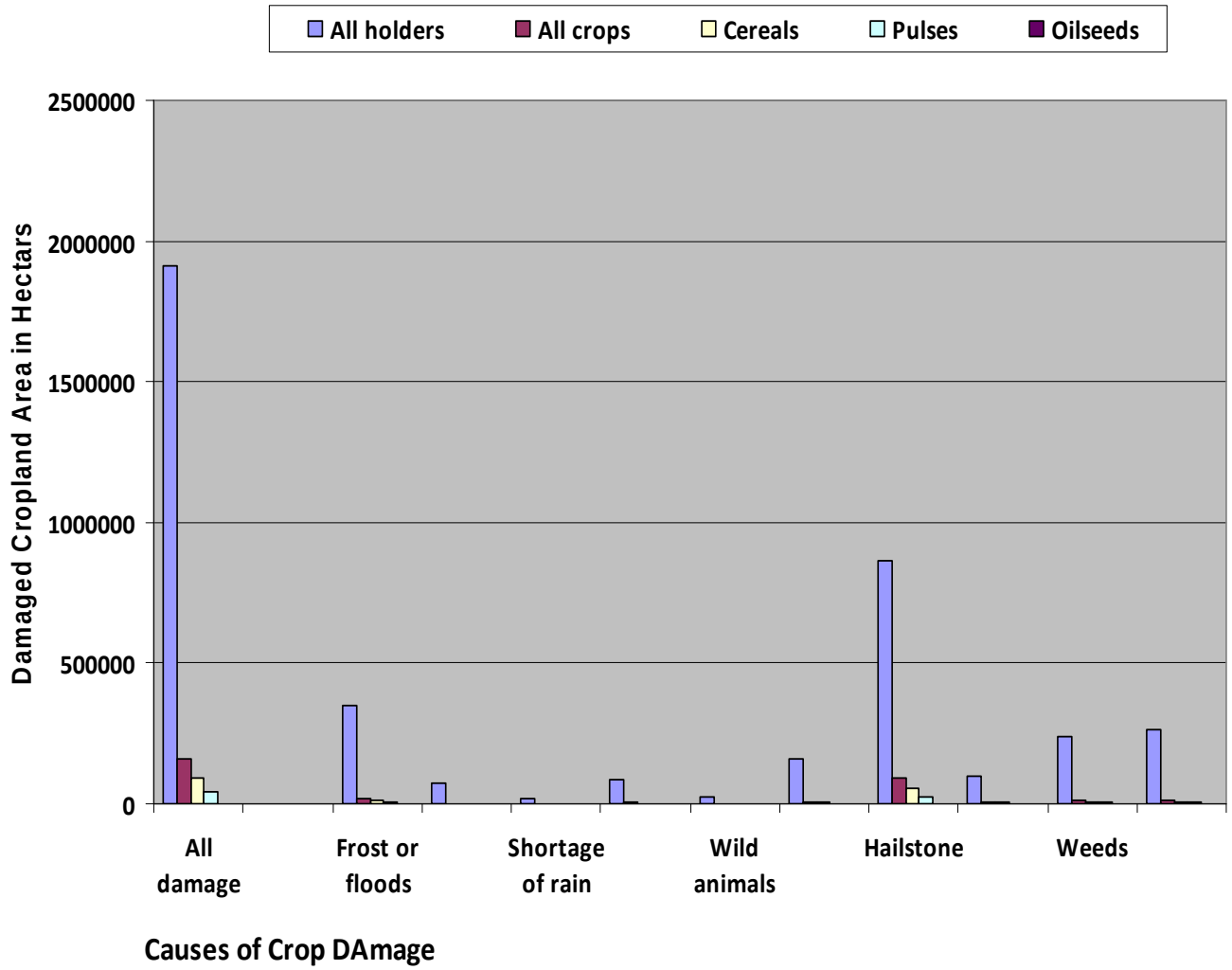
Holders Educational Status plays important role in the adoption of new and improved farming technologies. Therefore, in this report an attempt is made to categorize holders' reporting the use of modern farming practices during the 2012/13 Belg Season Crop Production activities based on their educational status. According to the results of the 2012/13 Belg Season Crop Production Sample Survey, out of the total number i.e **6,371,743** holders, out of which the highest number of holders who used chemical fertilizers, improved seed, pesticides and irrigation i.e. about **204,164; 42,380, 56,104**, and **34,995** holders were found to have Grade 4 – 6 educational status. In general, it was also estimated that number of illiterate holders were recorded more in all application of agricultural inputs as compared to number of literate holders.



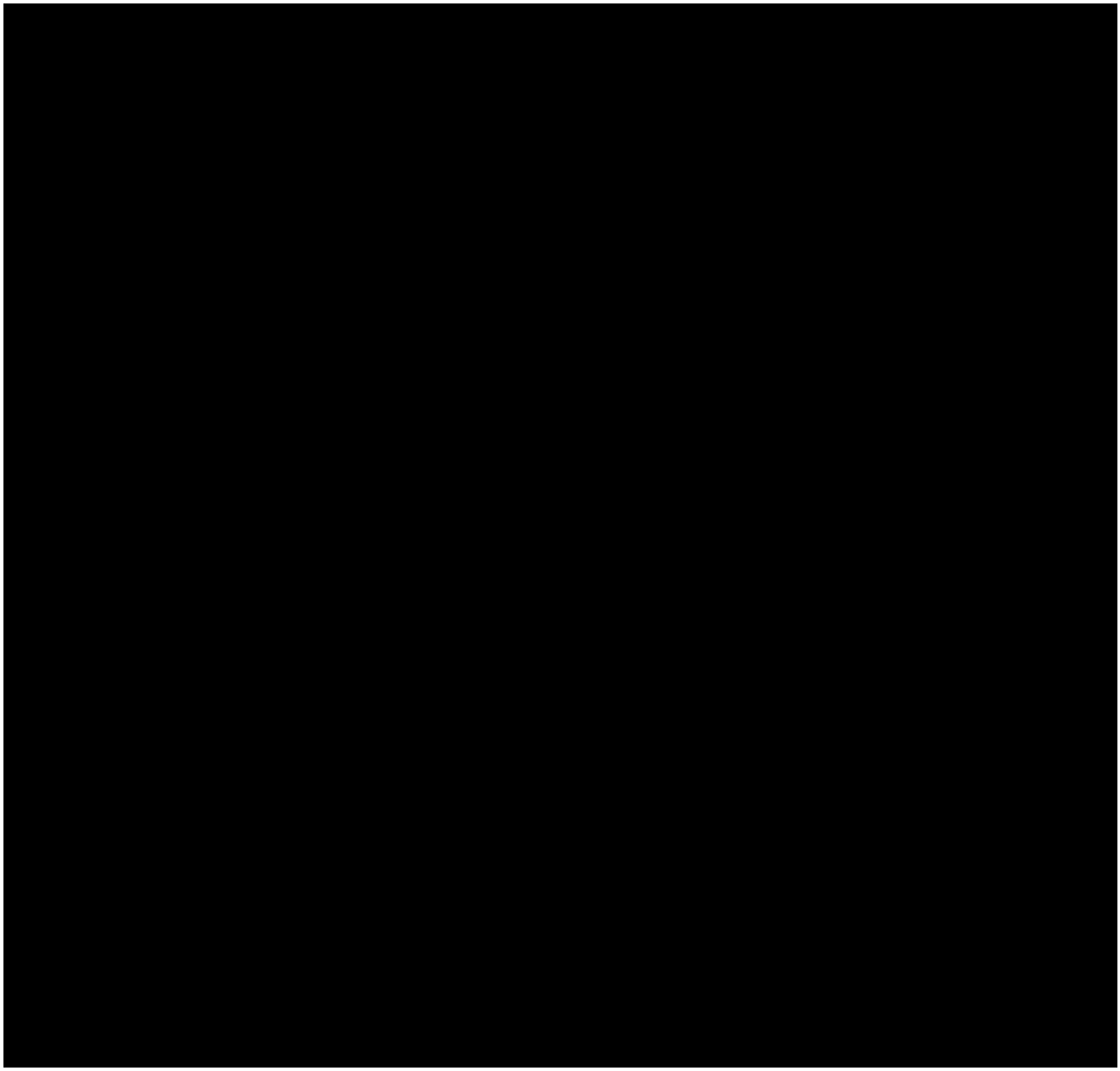
3.7 Number of Holders Reporting Damaged Cropland Area by Causes of Damage

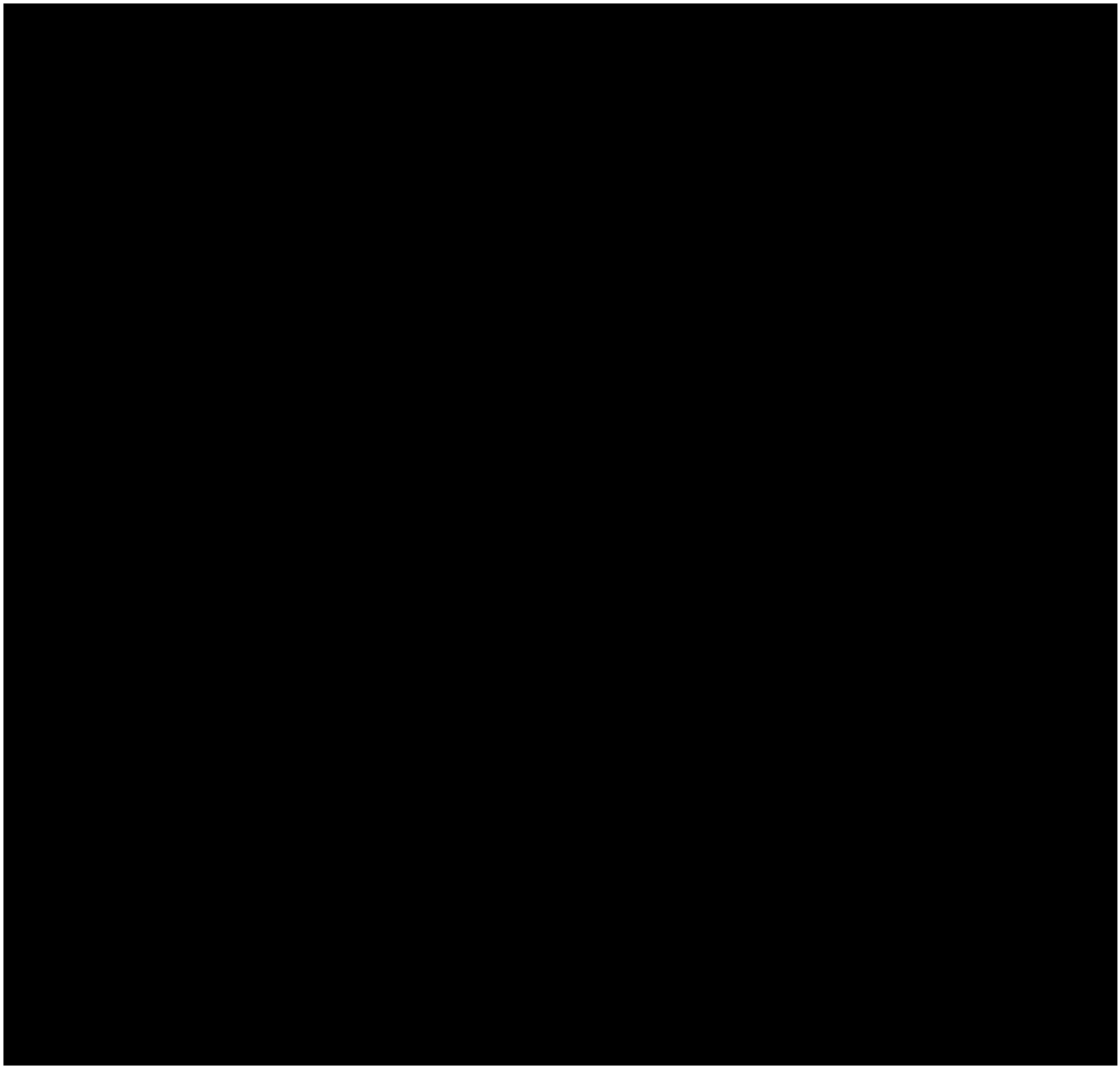
The total number of belg crop producing private peasant holders who reported crop damage and the cause of damage during the year 2012/13 Belg Season Crop Production harvest were estimated to be about 1,912,625 and the damaged cropland area was estimated to be 156,648 hectares. As indicated in Table 4, the highest cropland area was reported for cereals, that are 94,148 hectares, followed by pulses, which is 40,760 hectares and then Oil crops with 7,172 hectares of damaged cropland area**.** With regard to the causes of crop damage, it is reported that 90,180 hectares was damged due to Halistone the second highest crop damage which is estimated at 20,130 hecares was damaged by frost or floods. For details, see Table 4 and Fig 5.

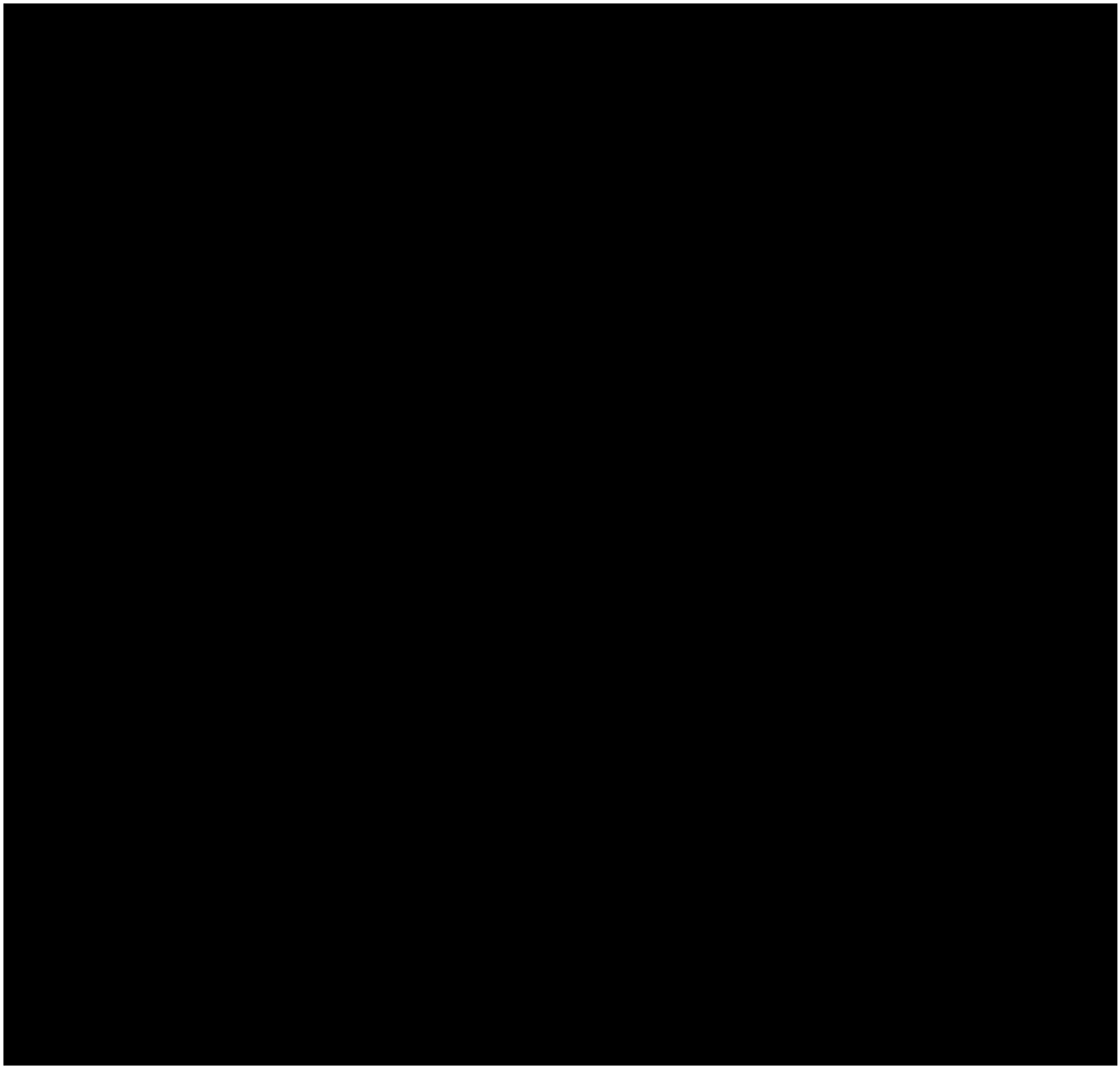
Fig5: Damaged Cropland Area by causes of damage and crop catagory, 2012/13(2005 E.C) belg season

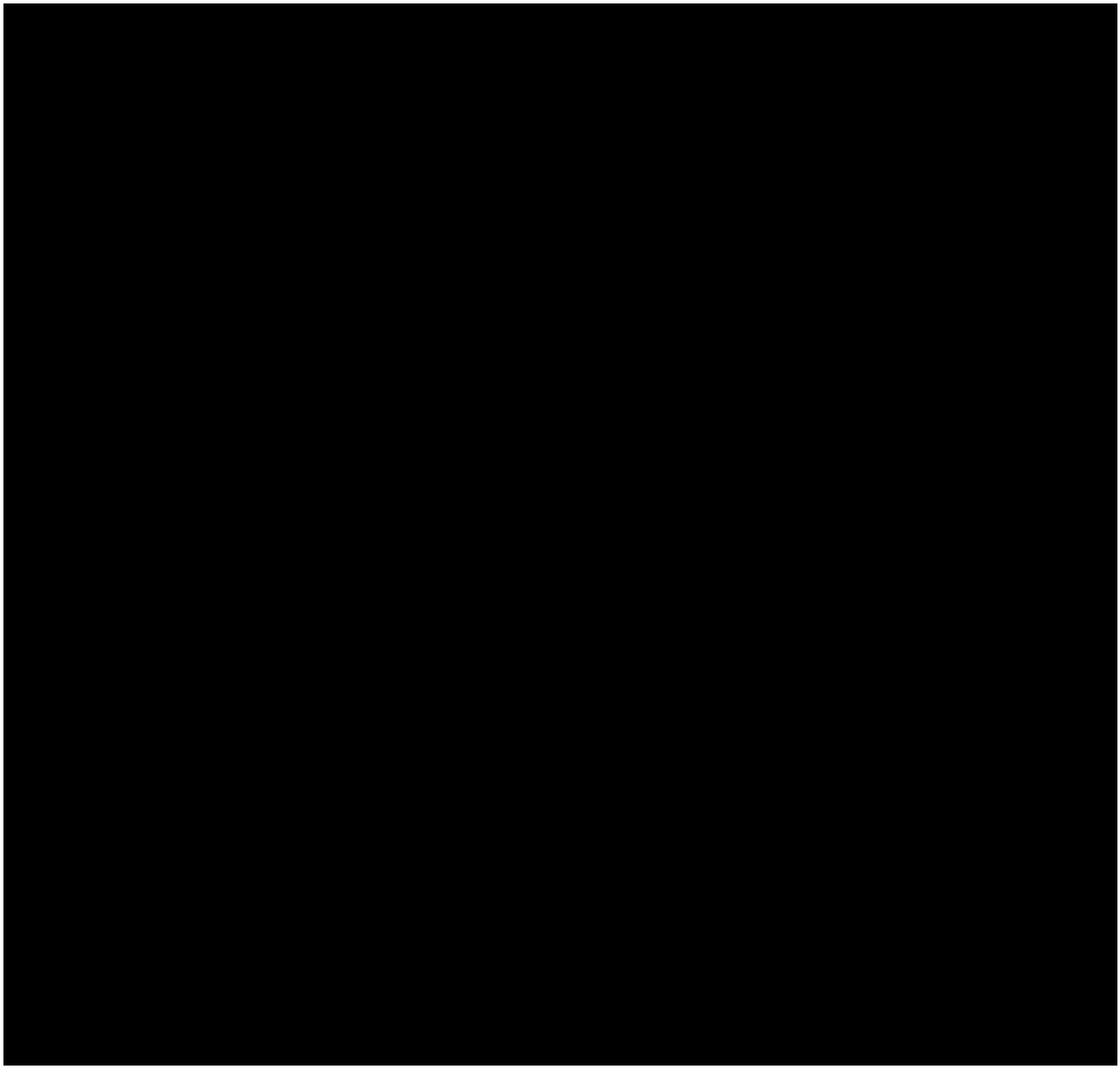


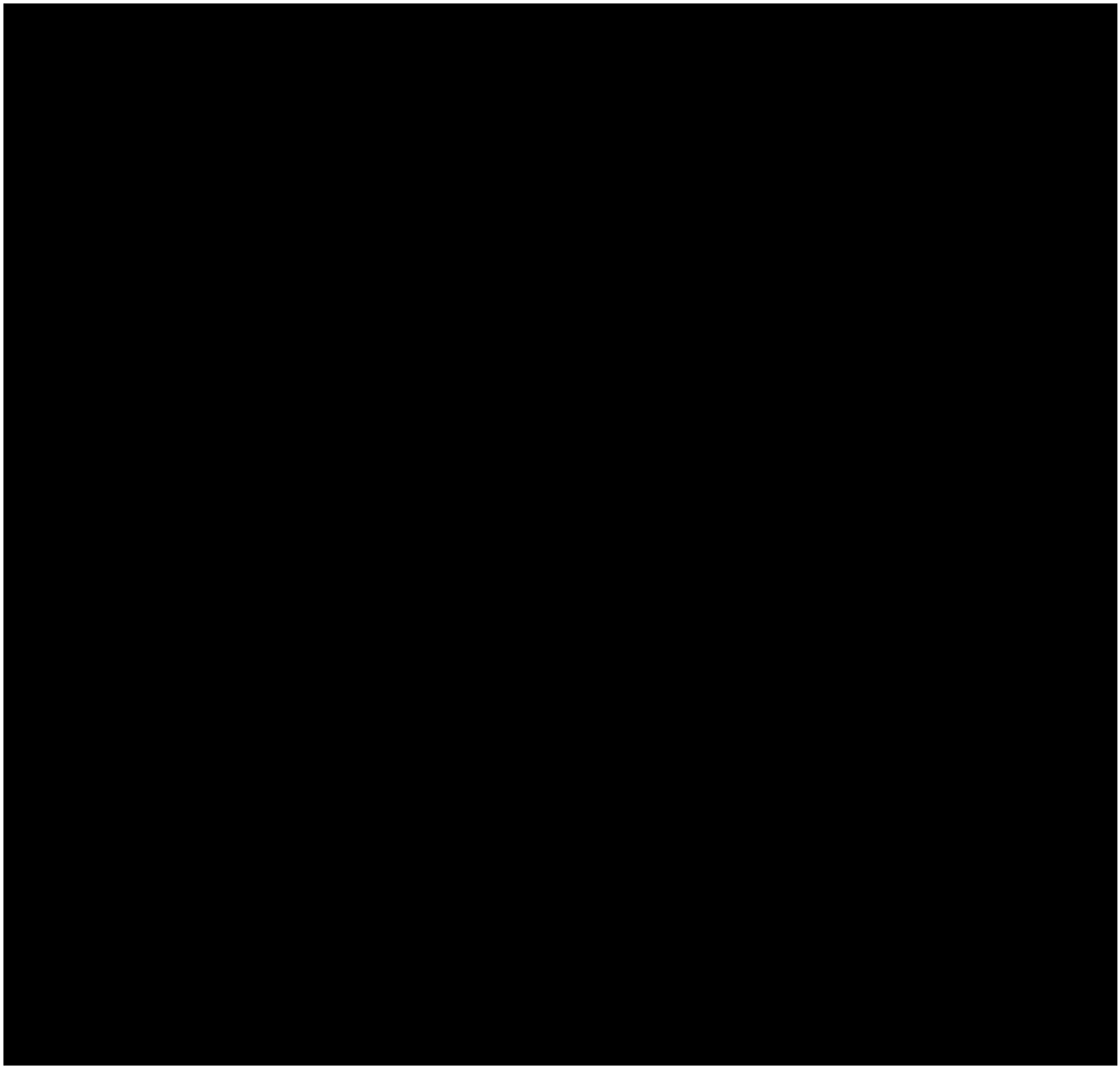
National and Regional Statistical Tables

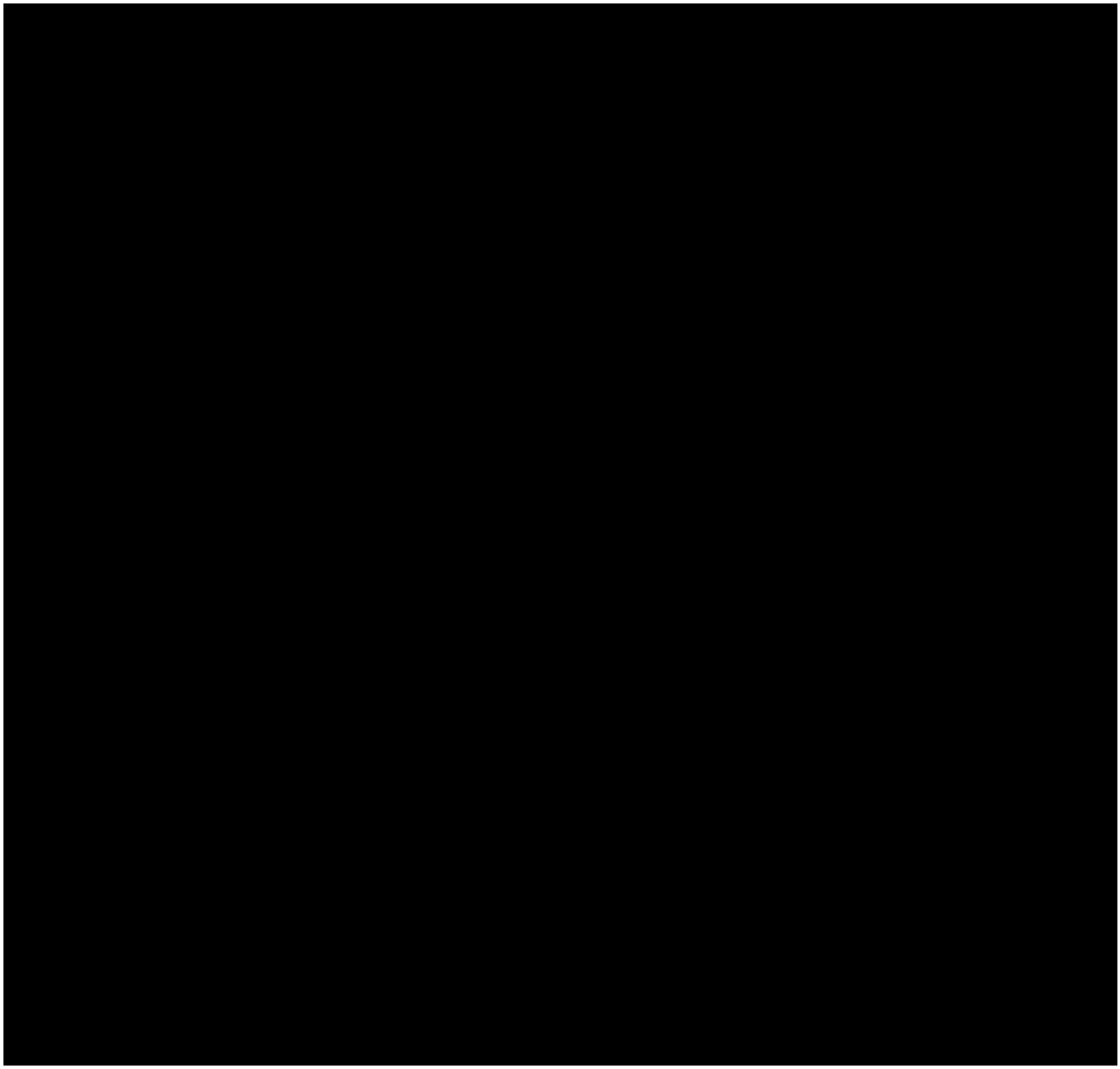


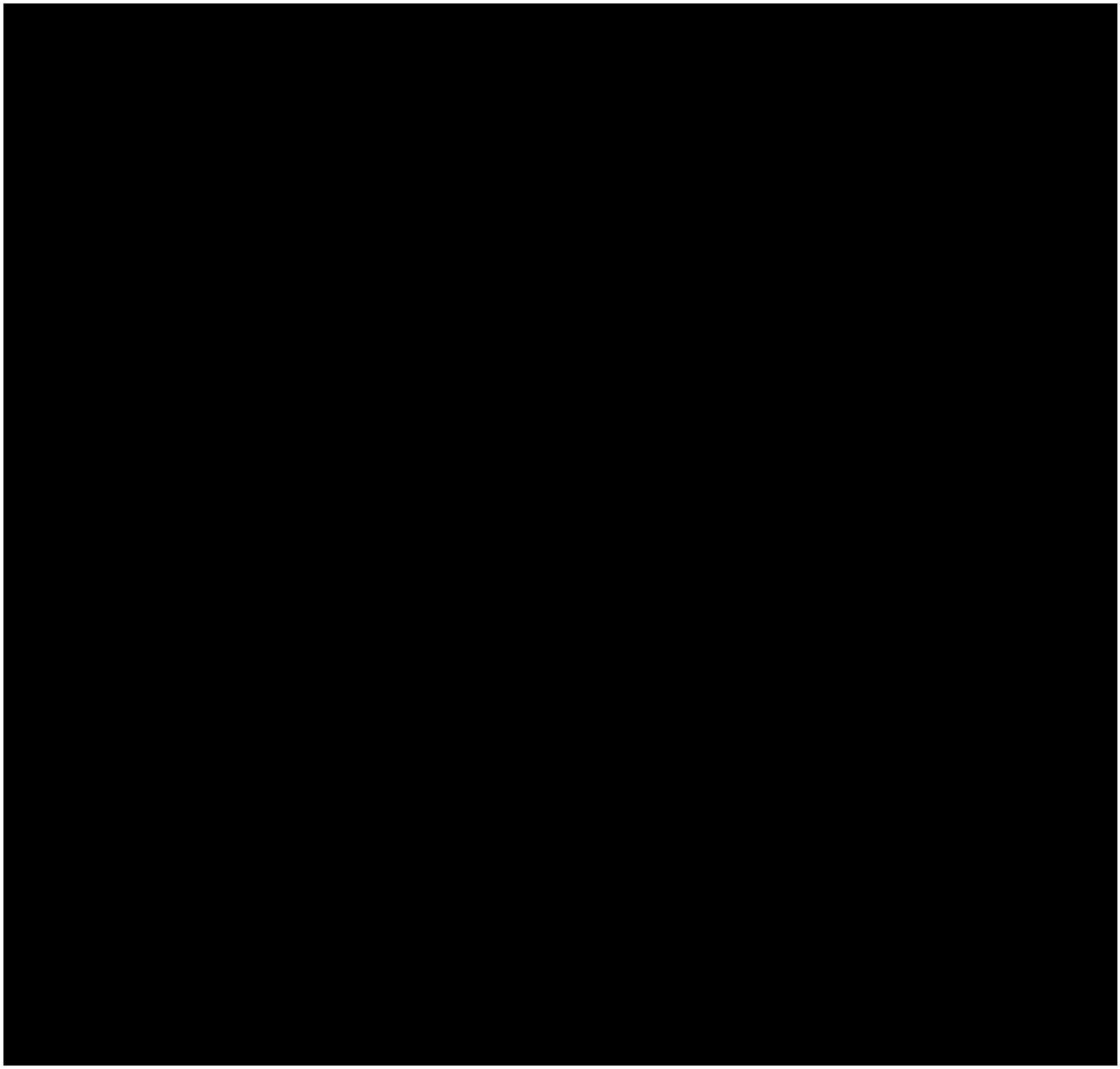


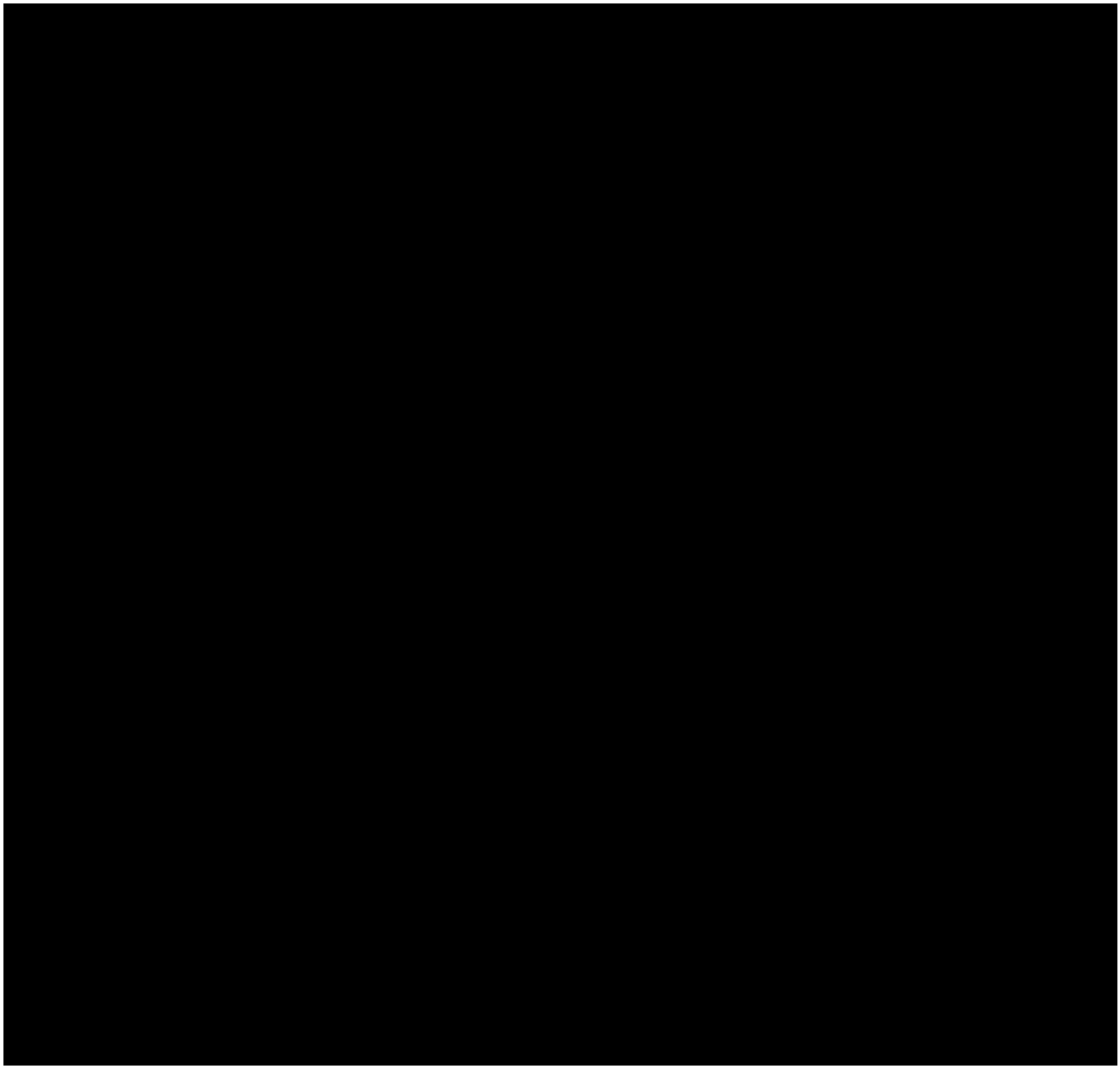


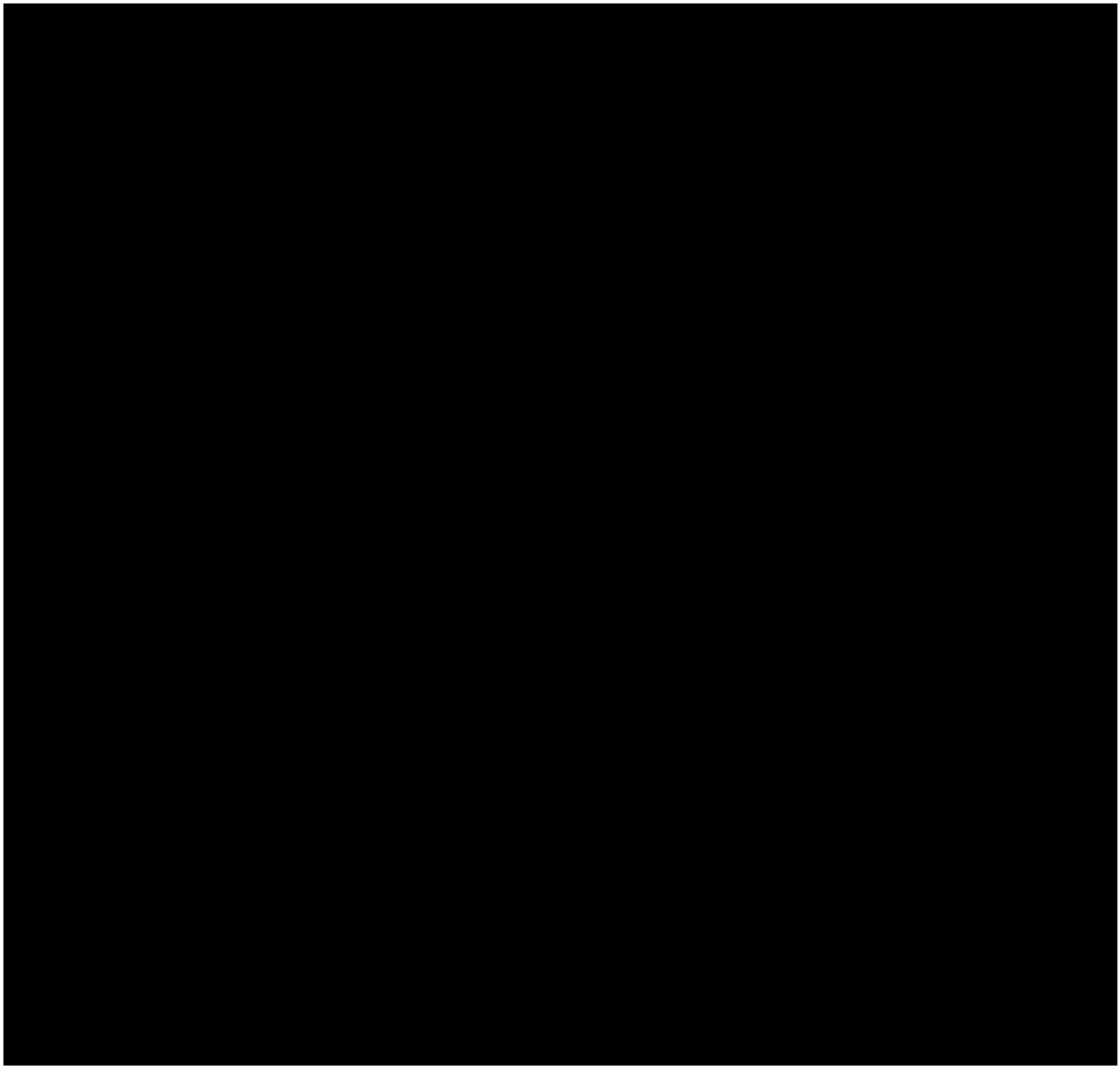


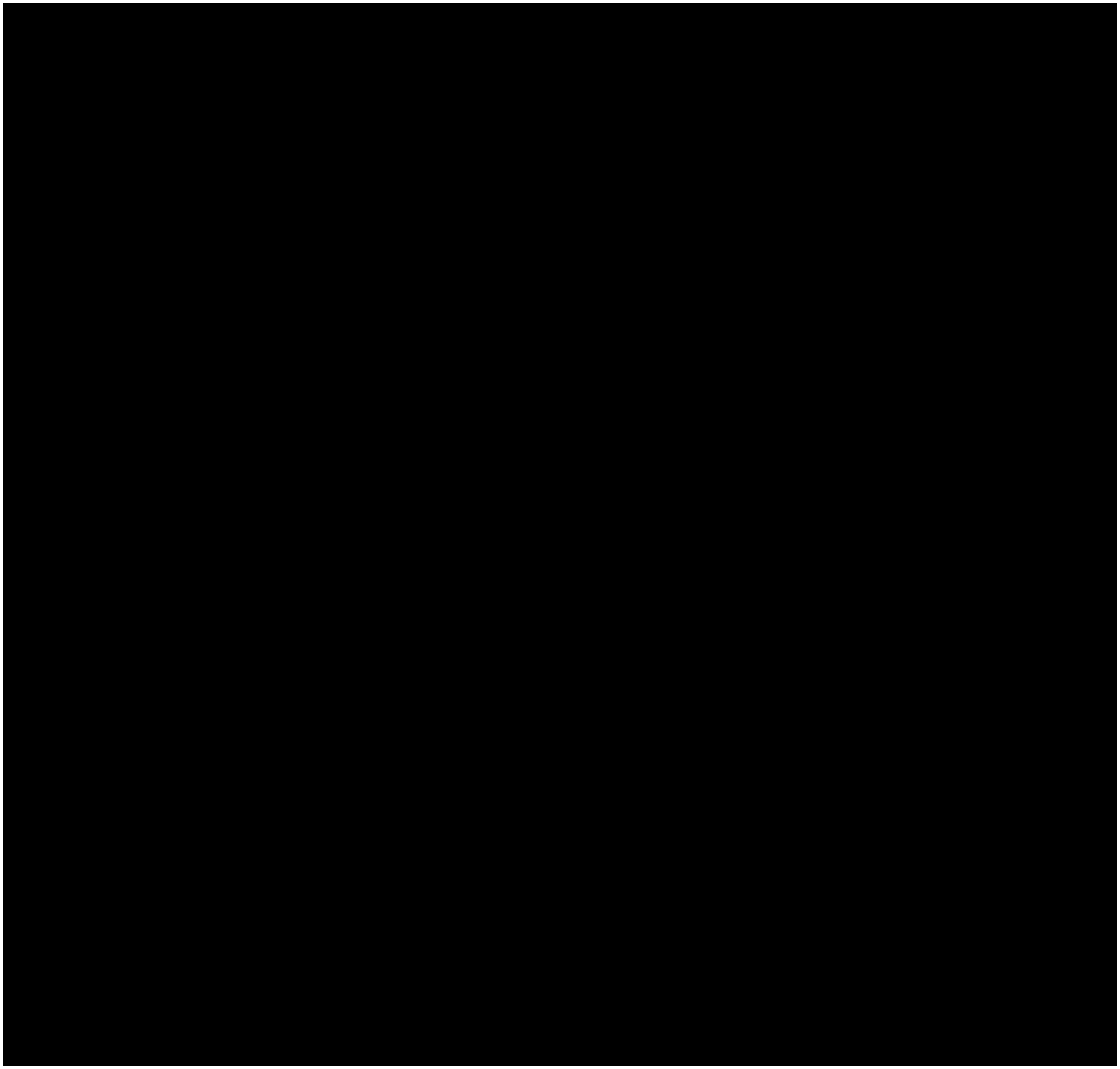


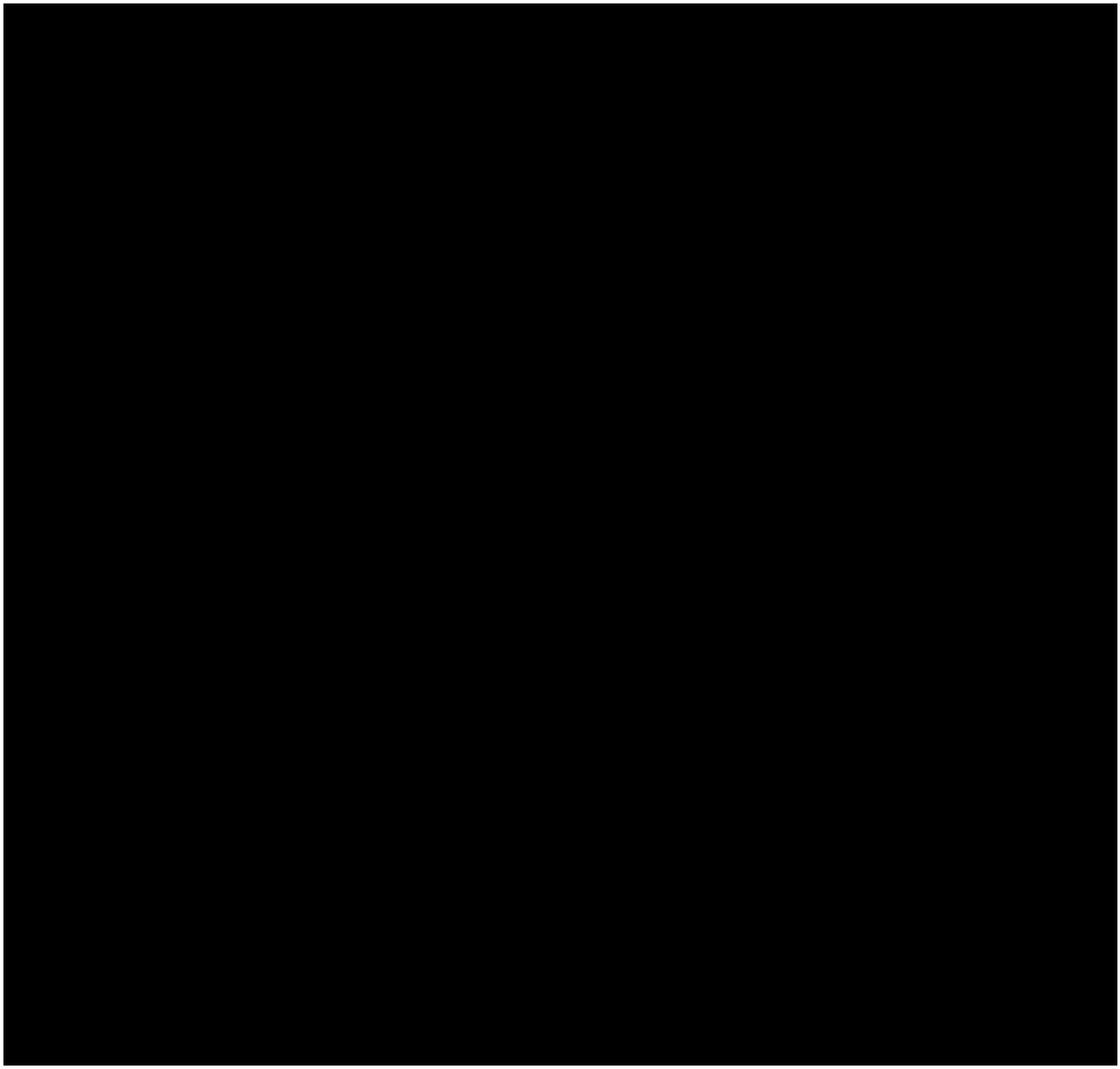


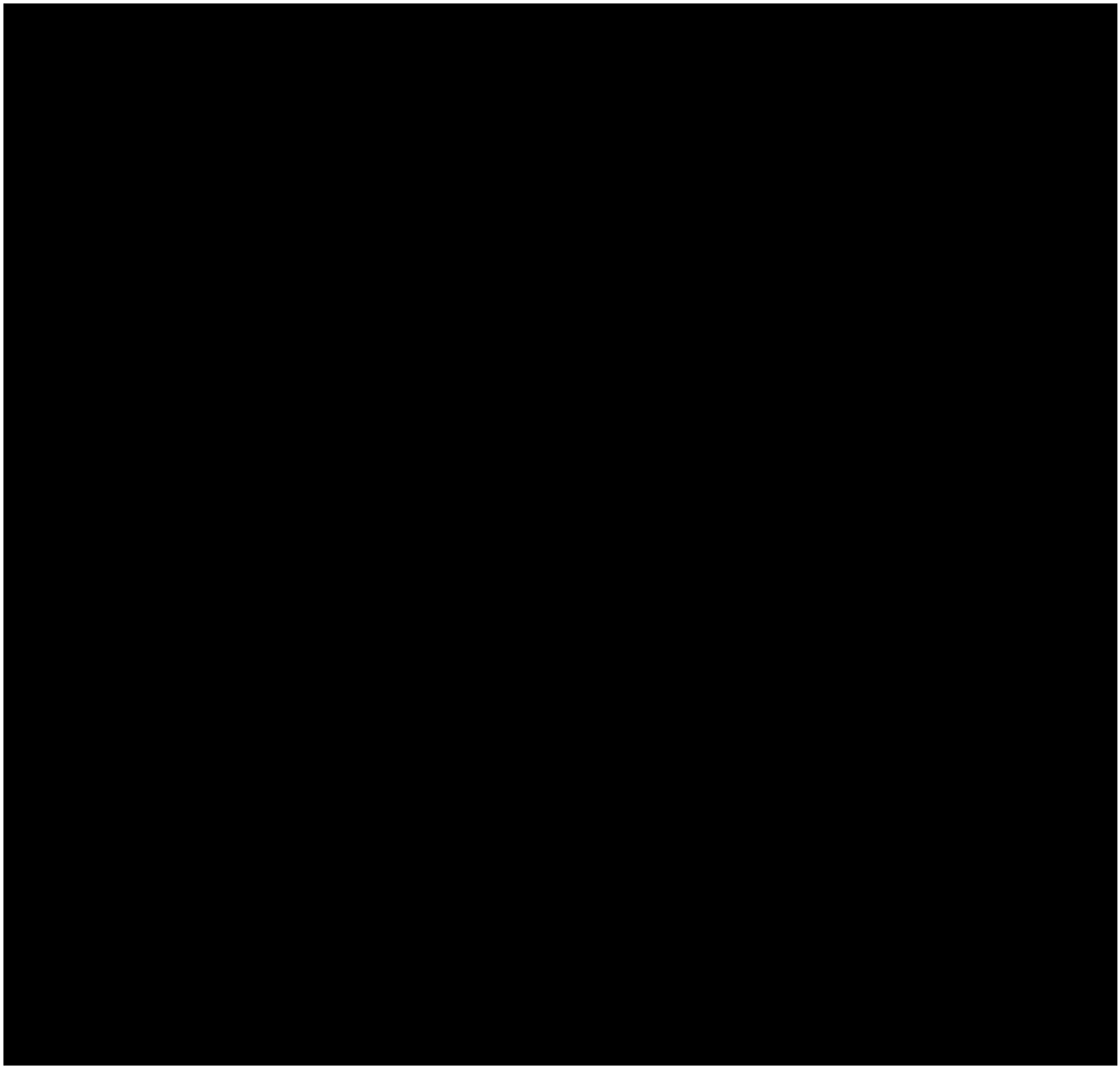


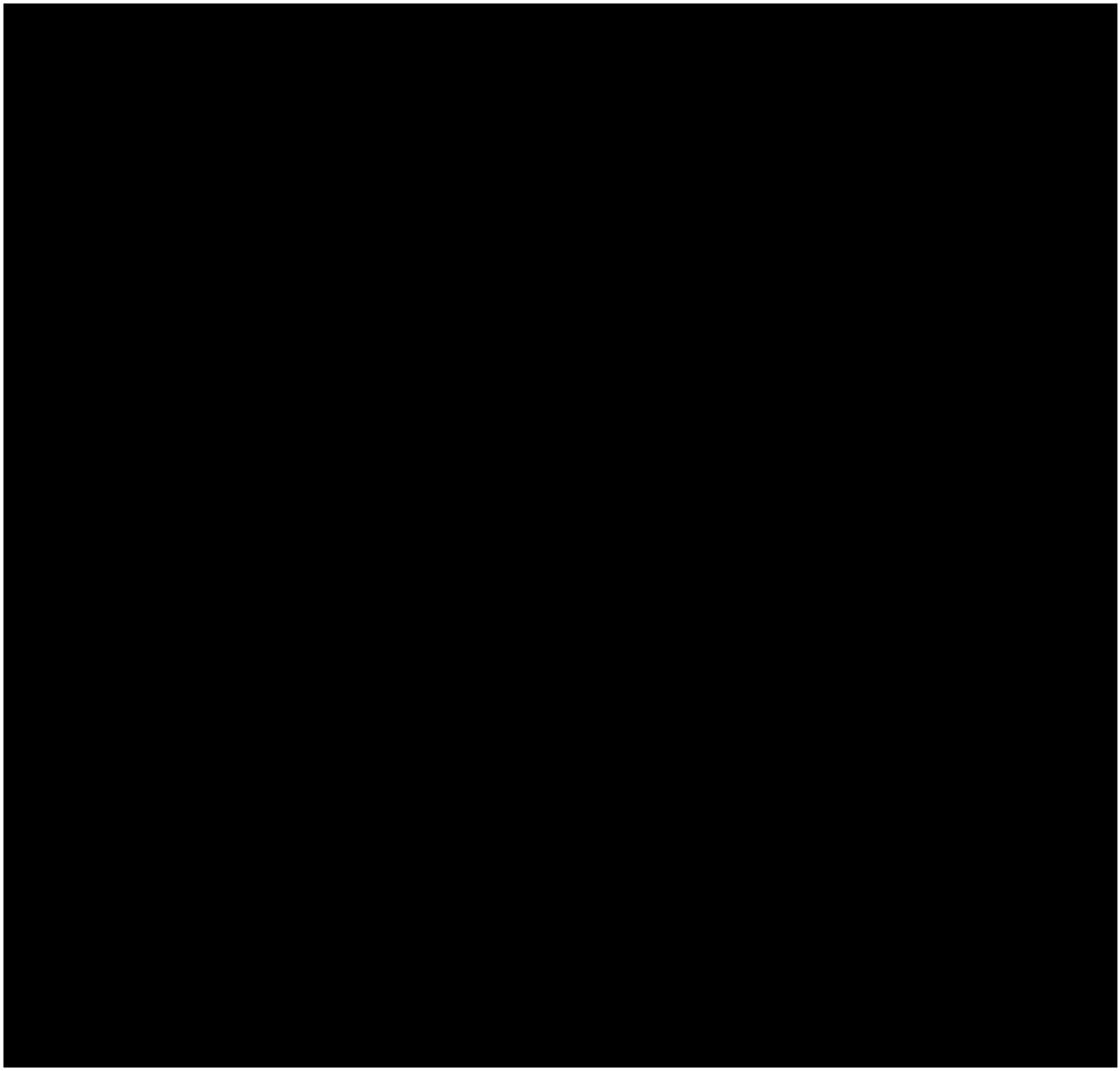


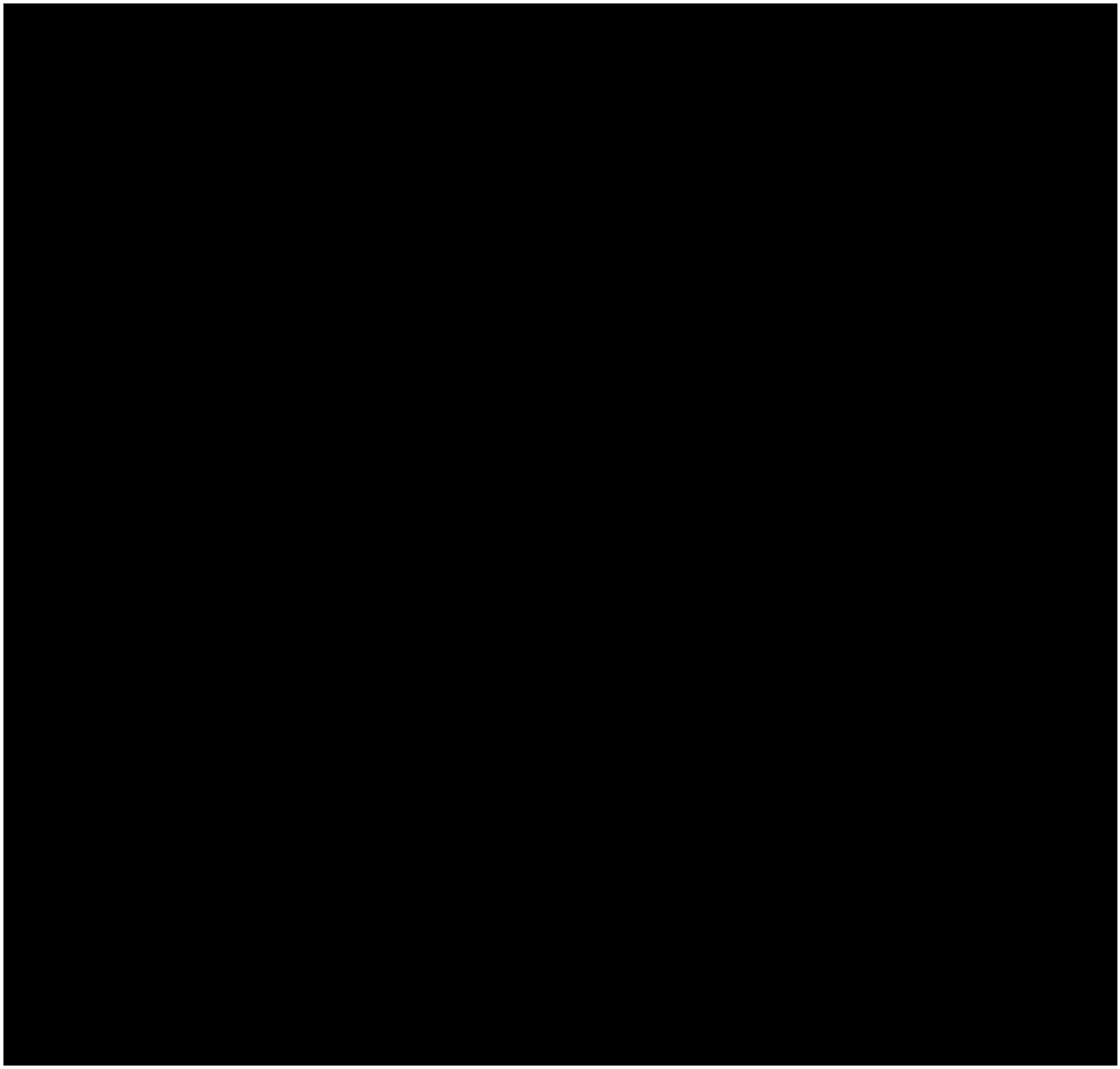


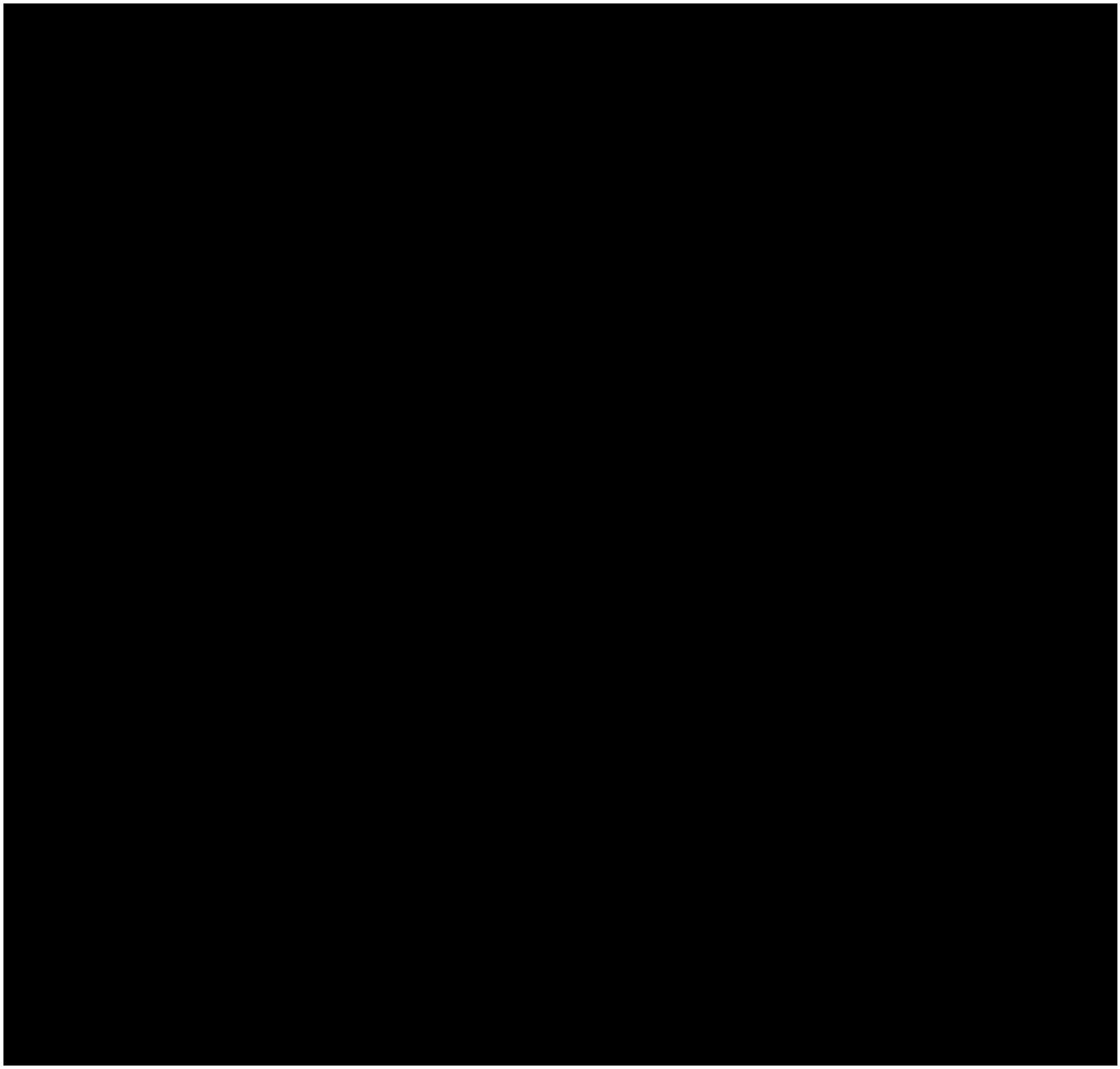


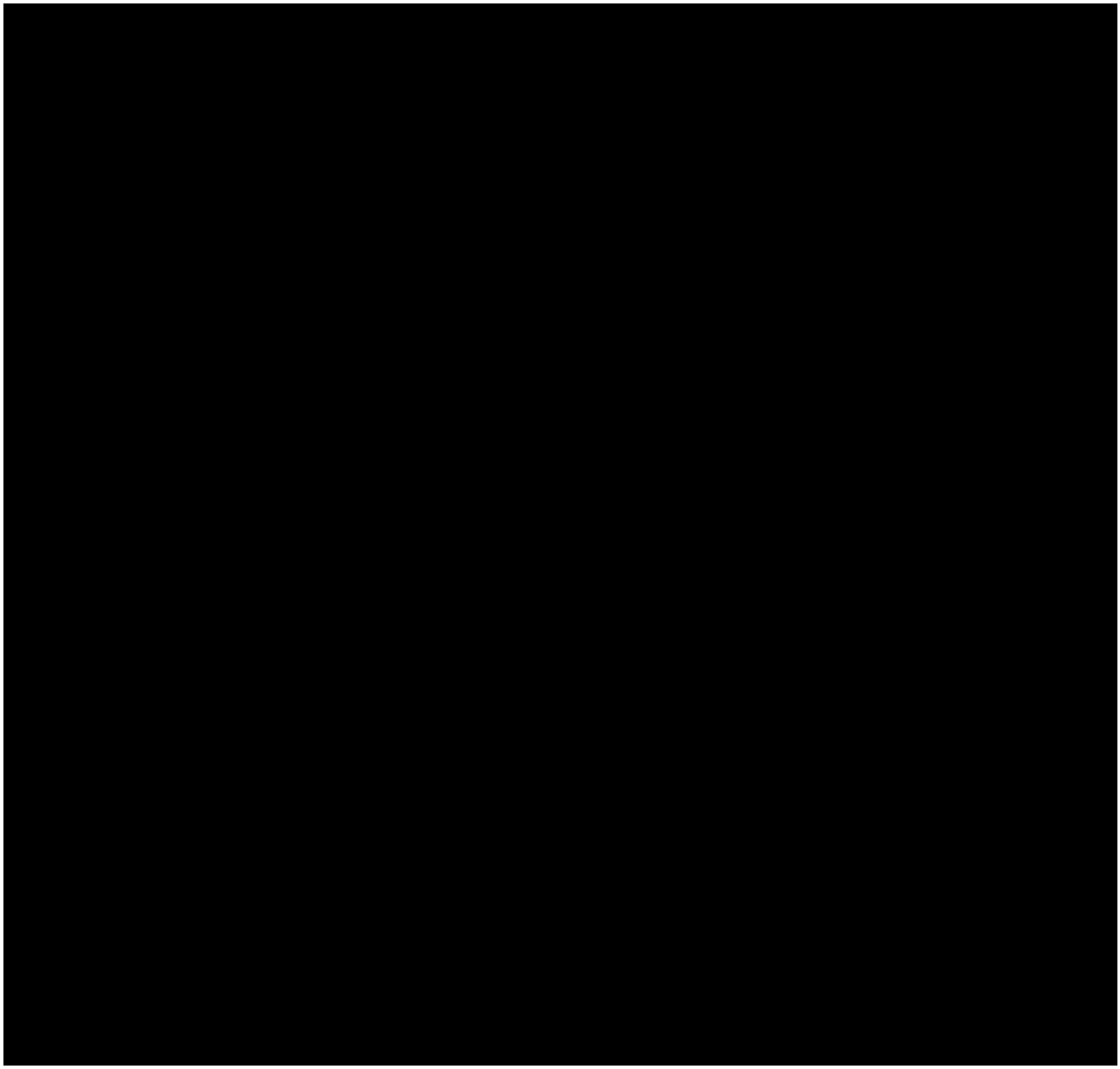


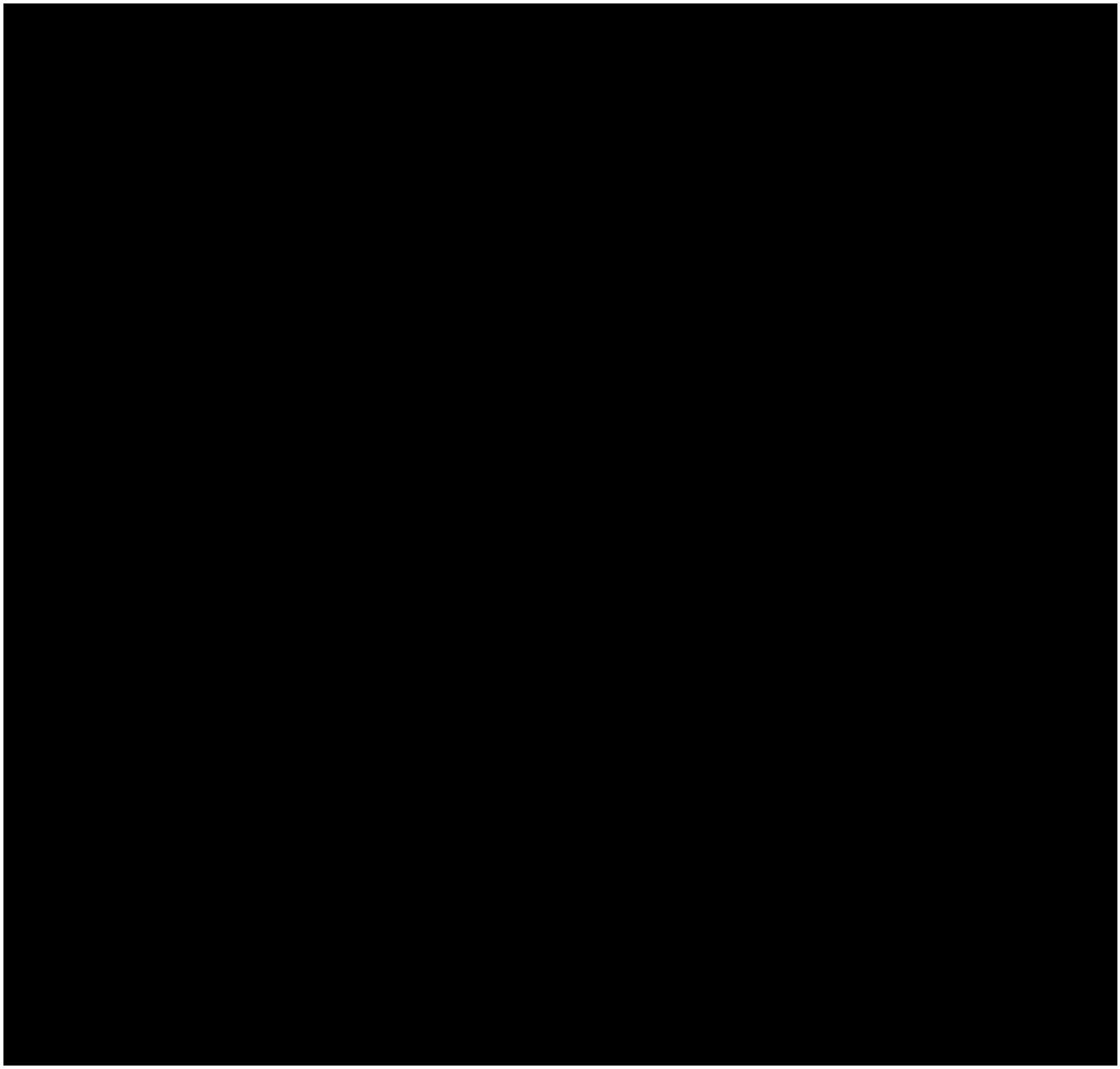


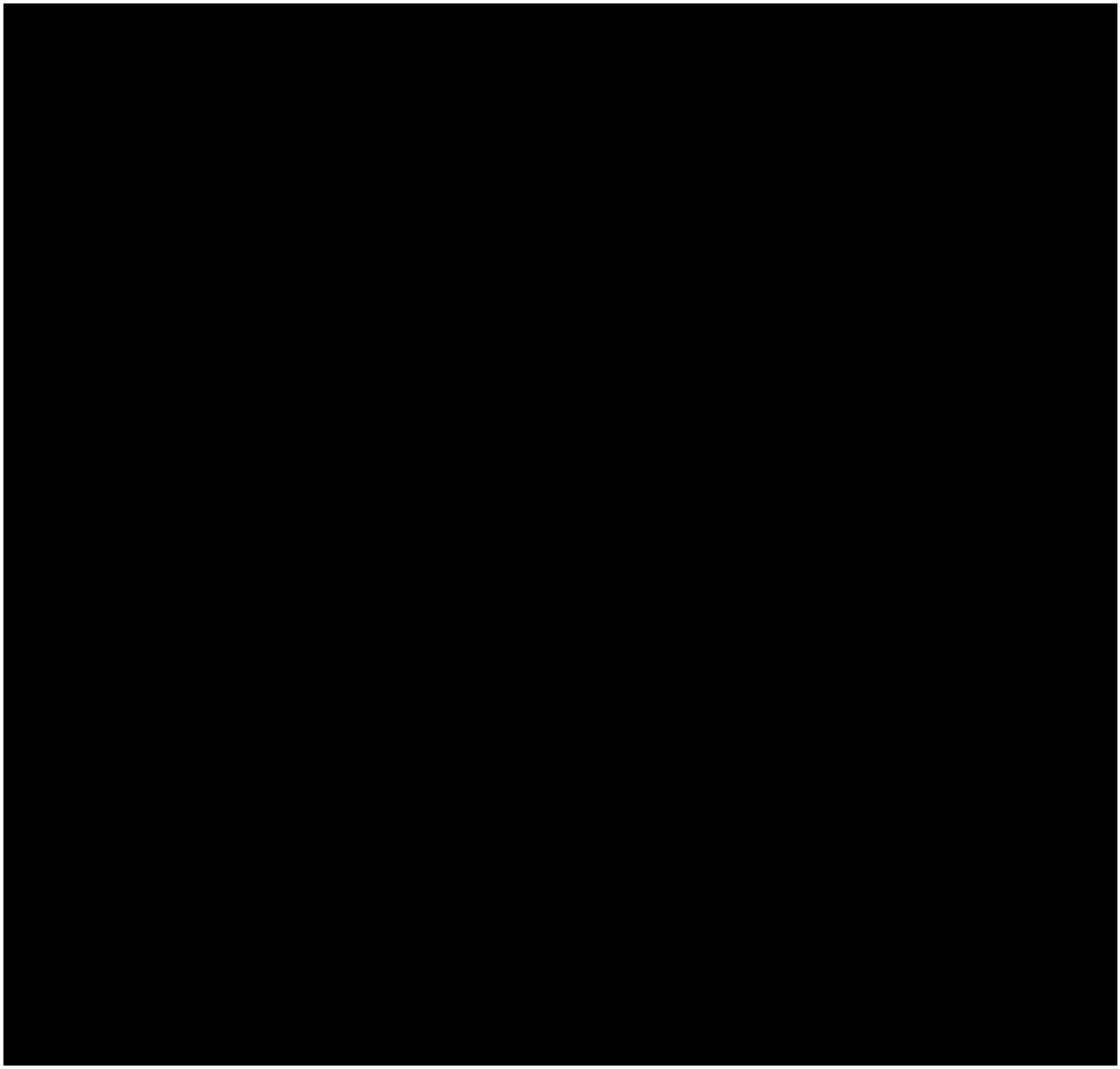


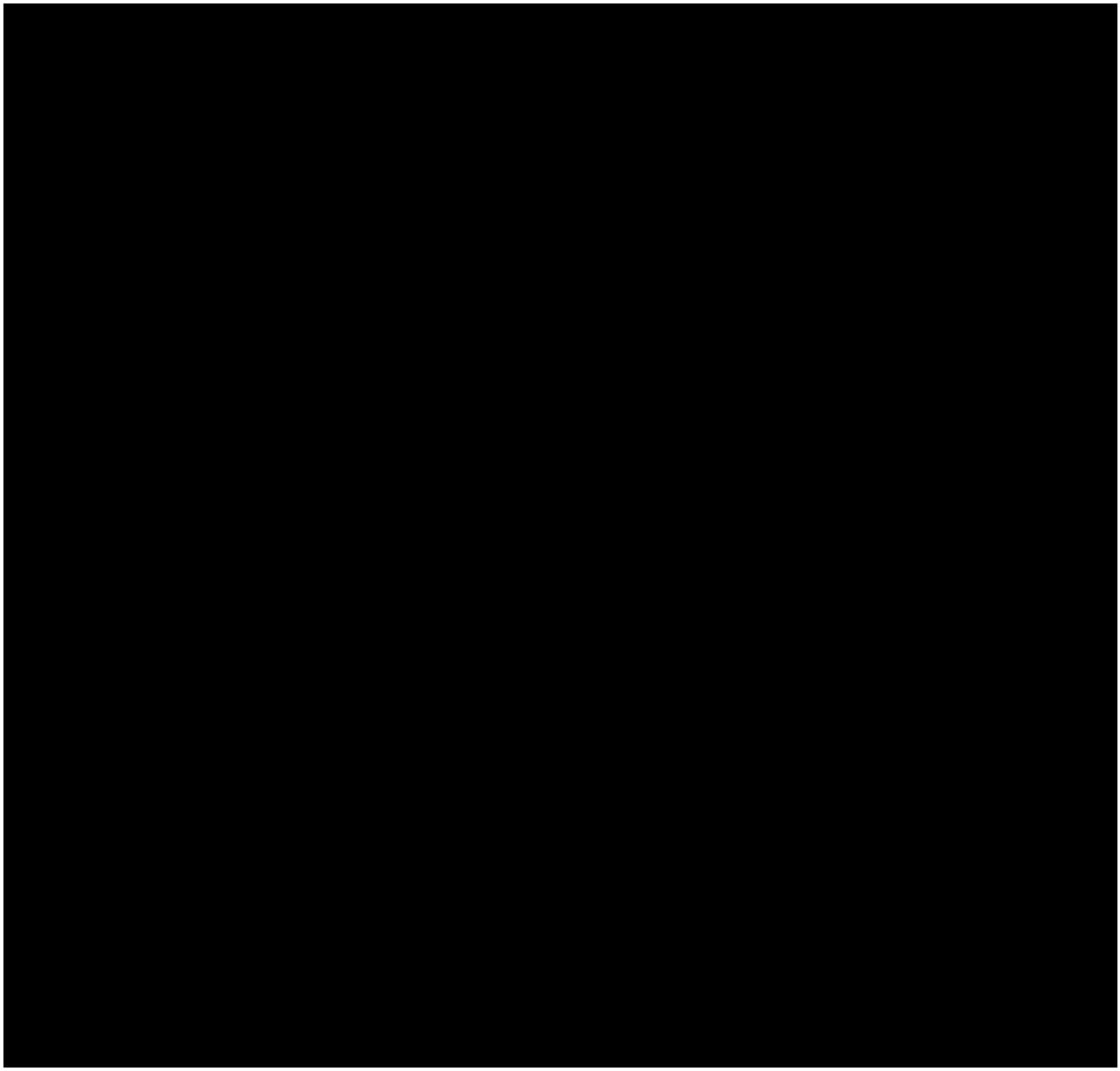


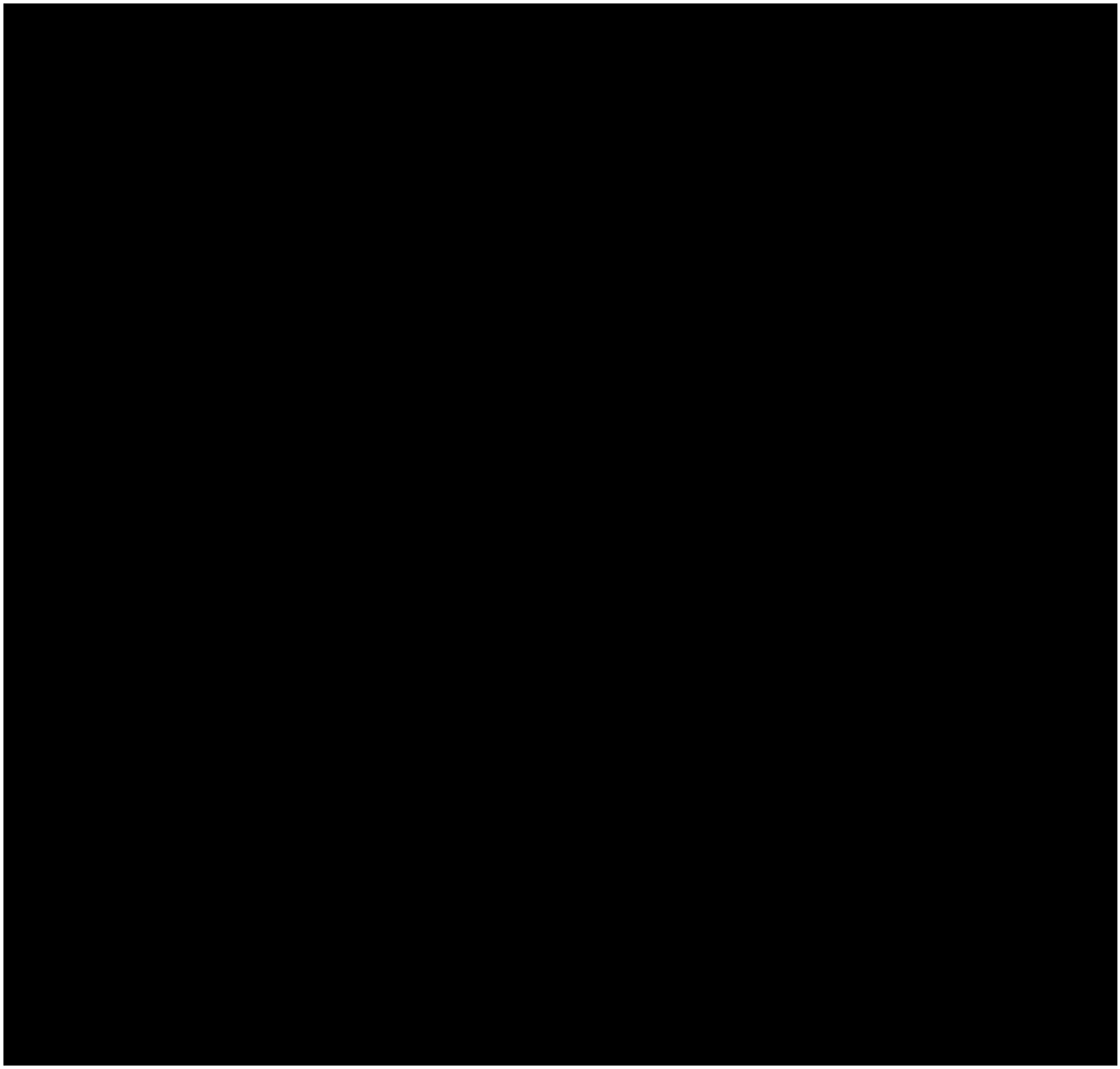


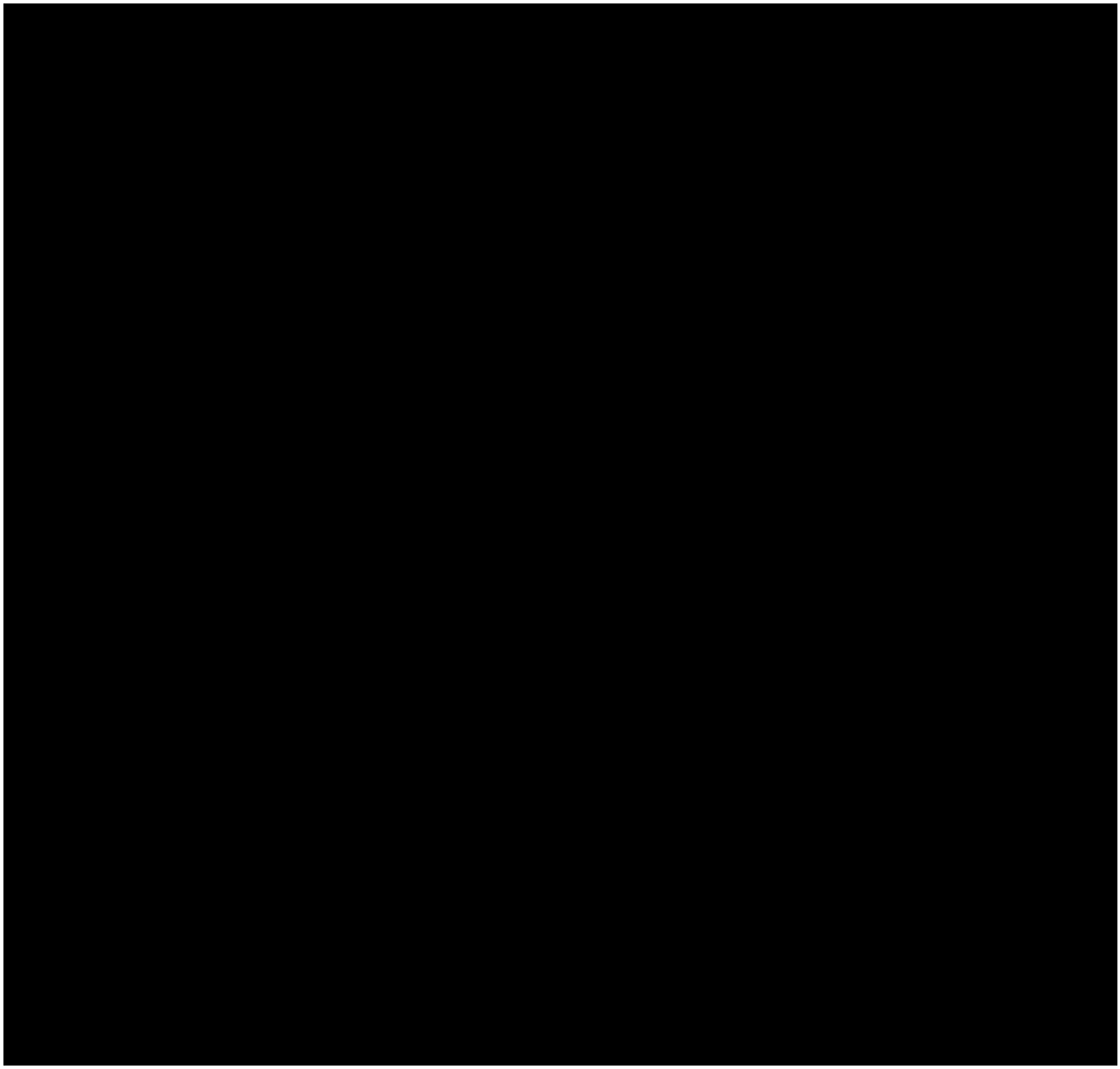


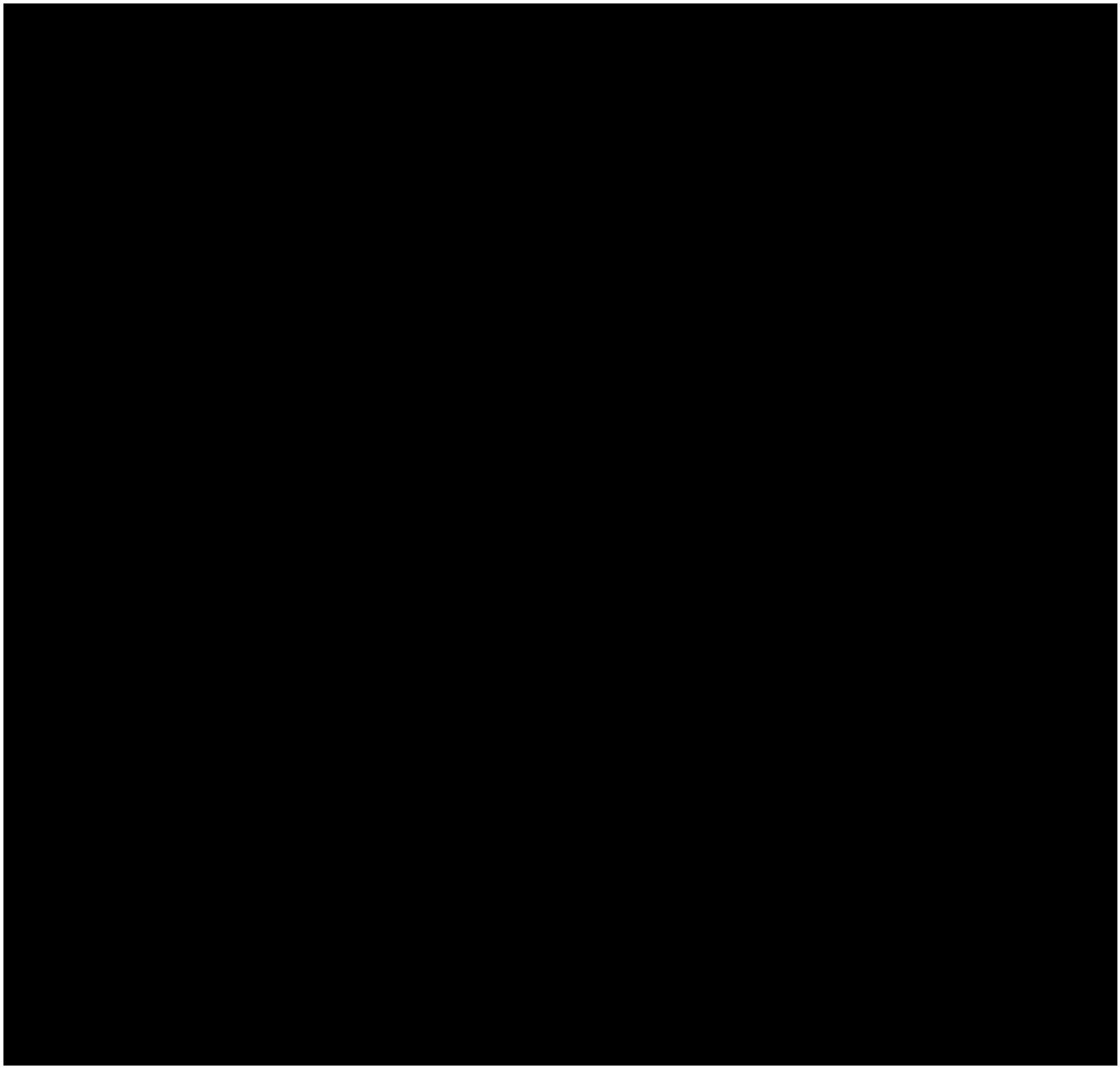


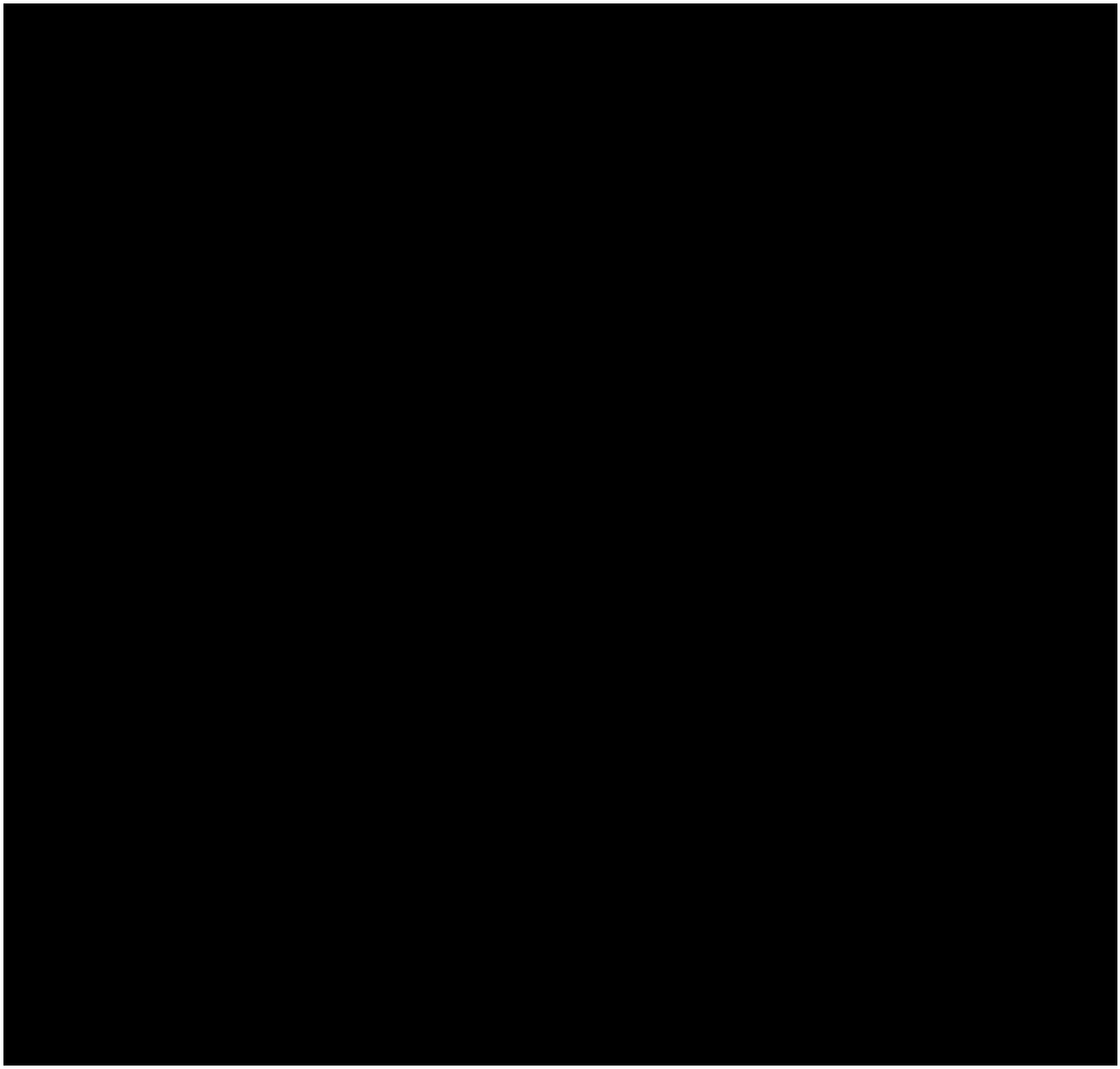


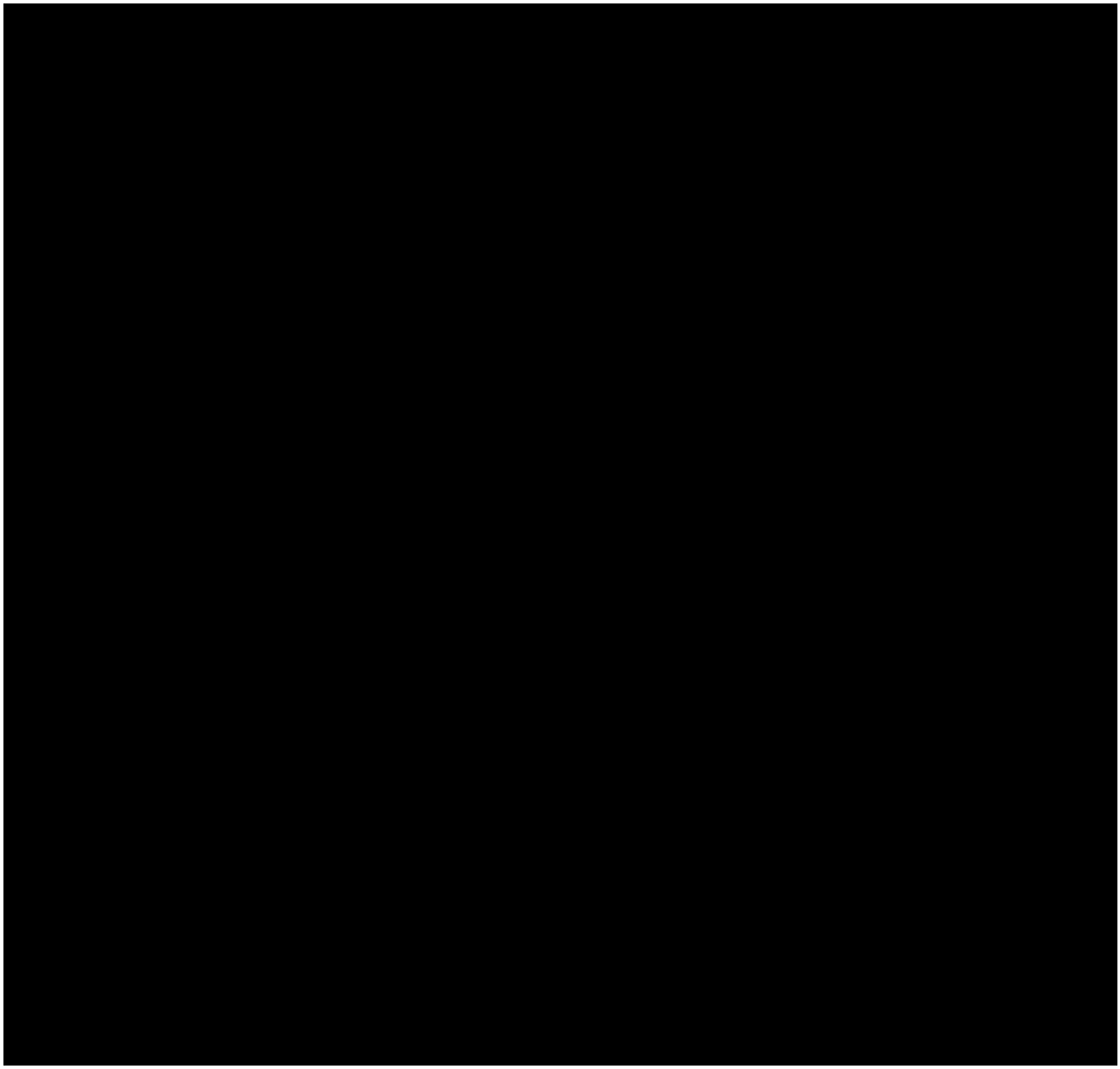


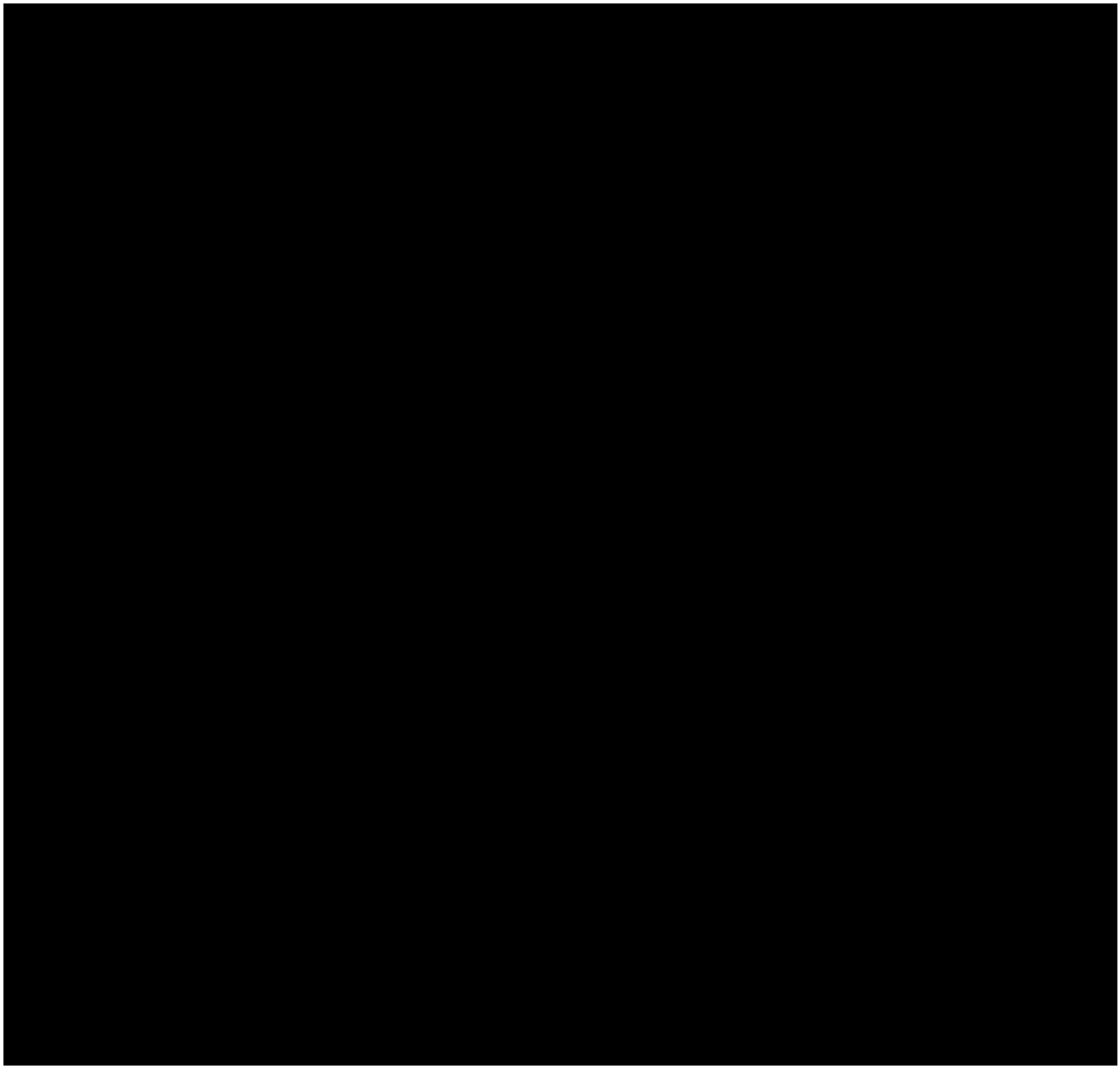


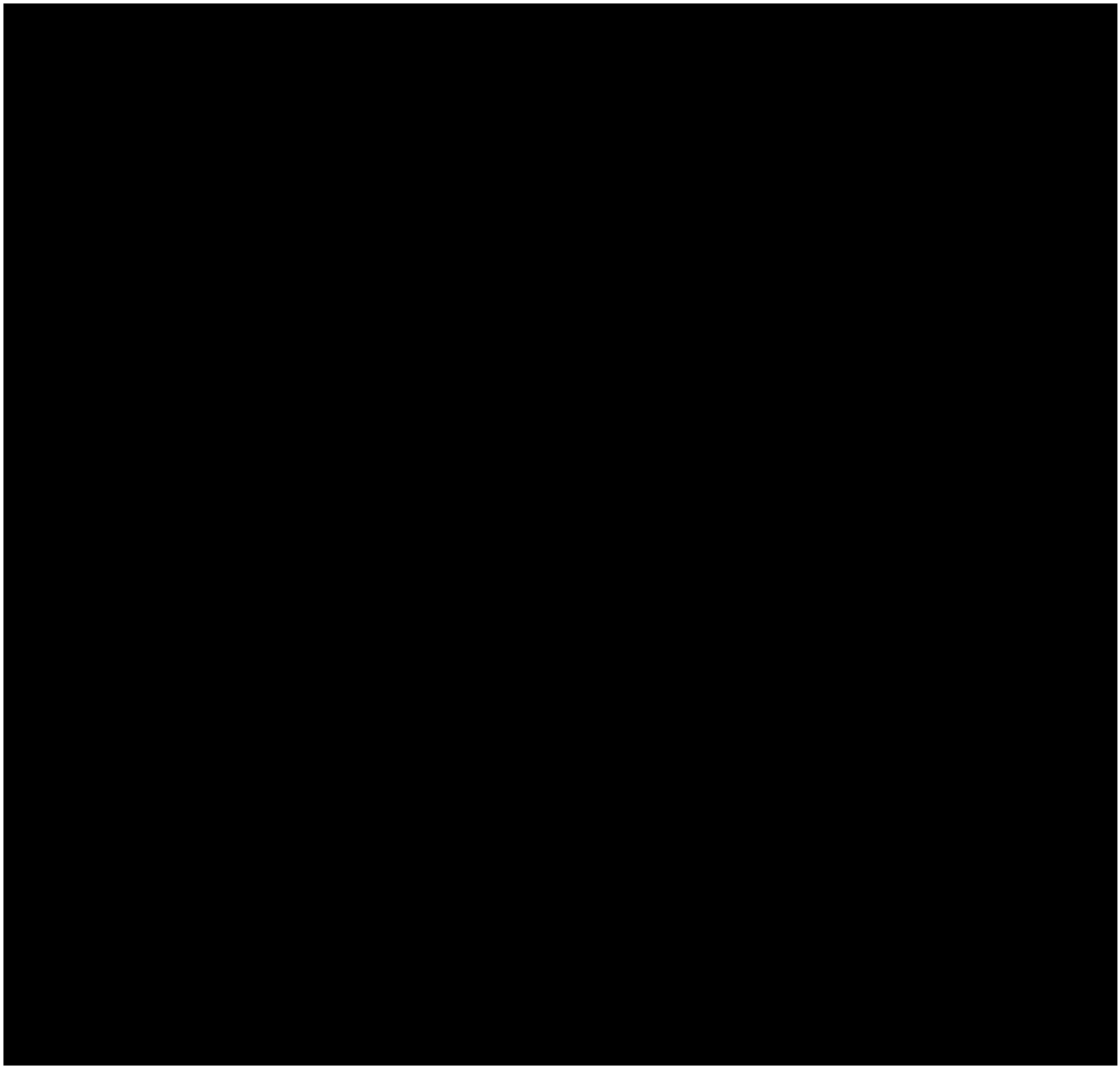


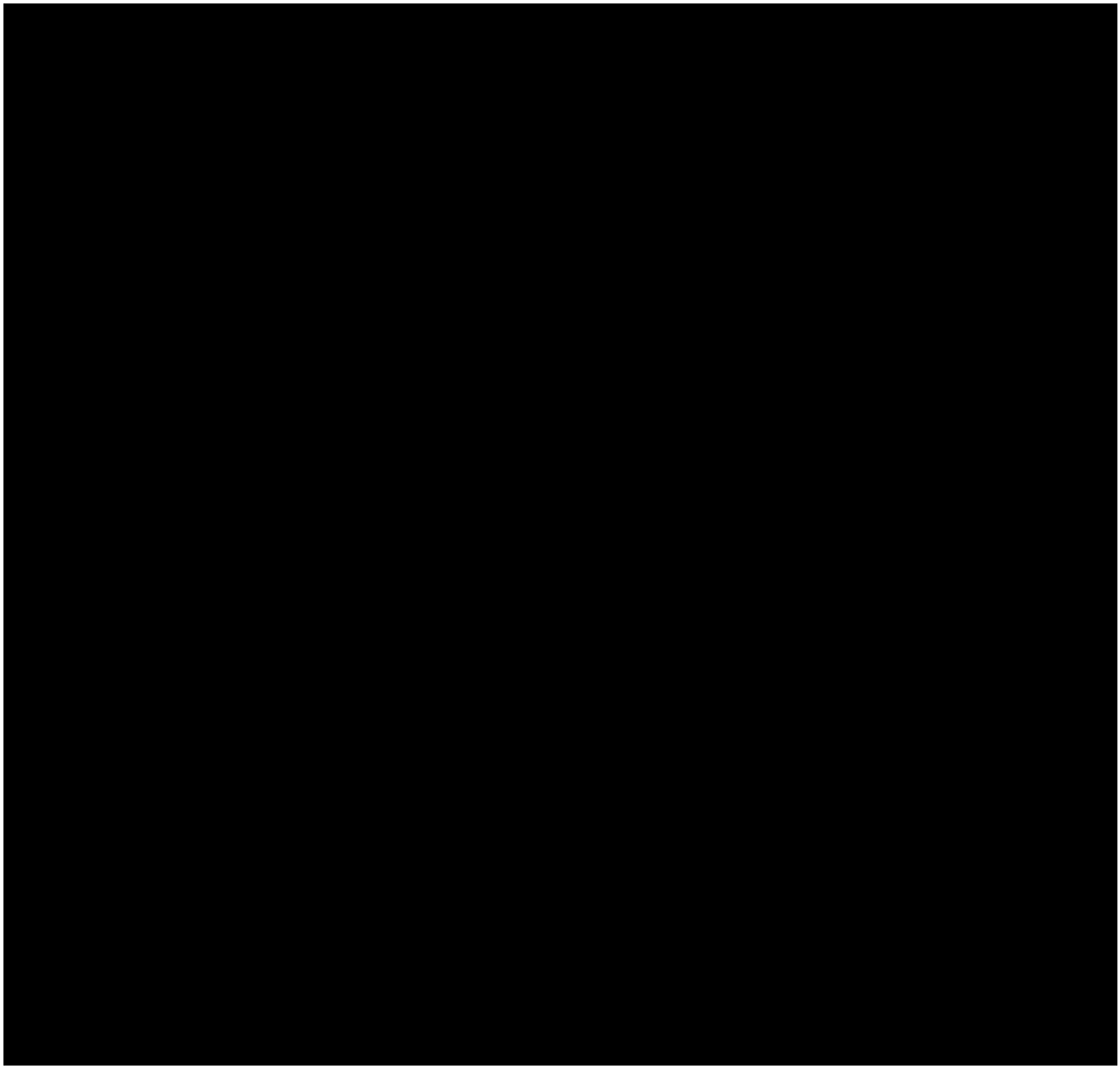


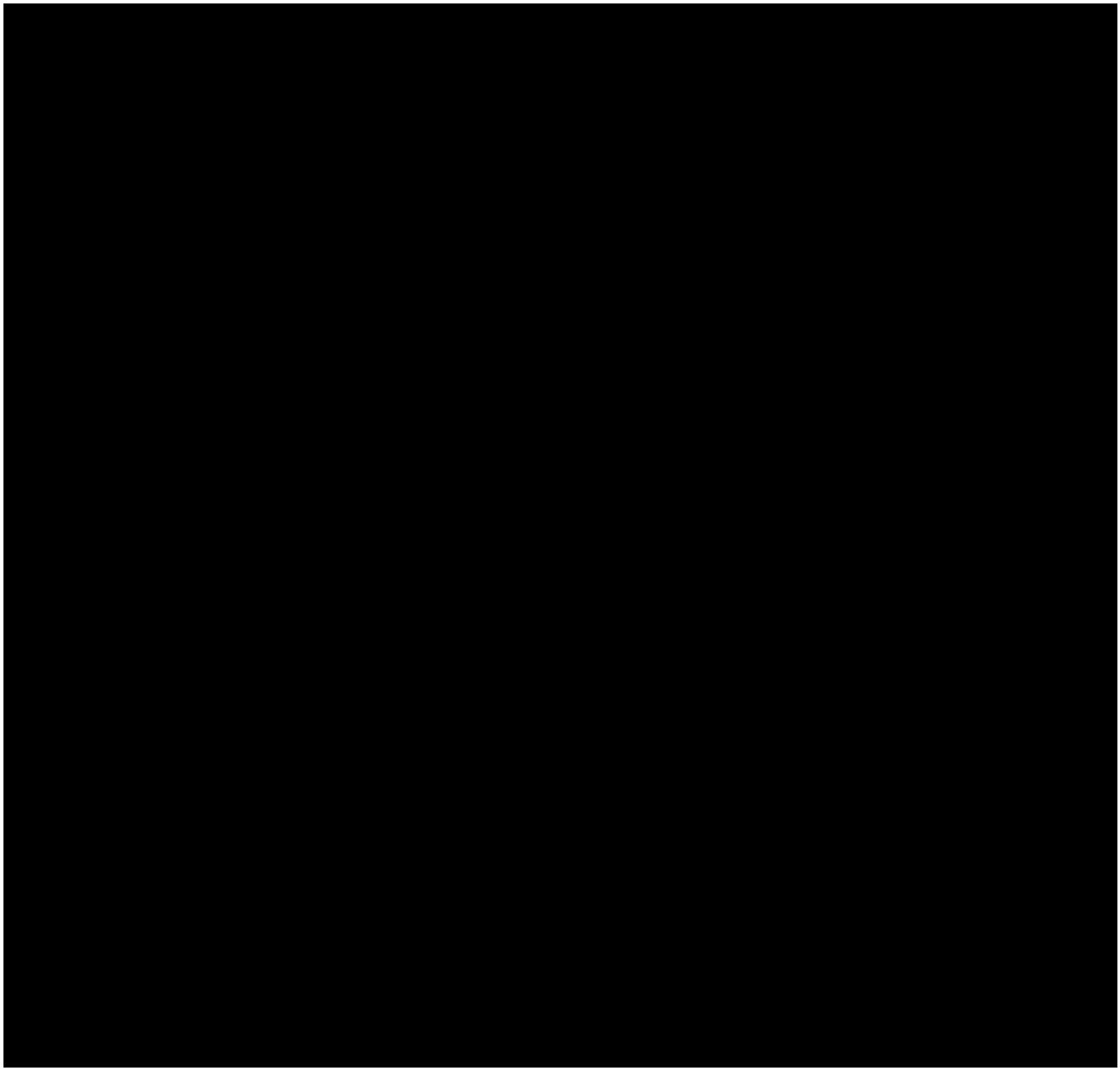


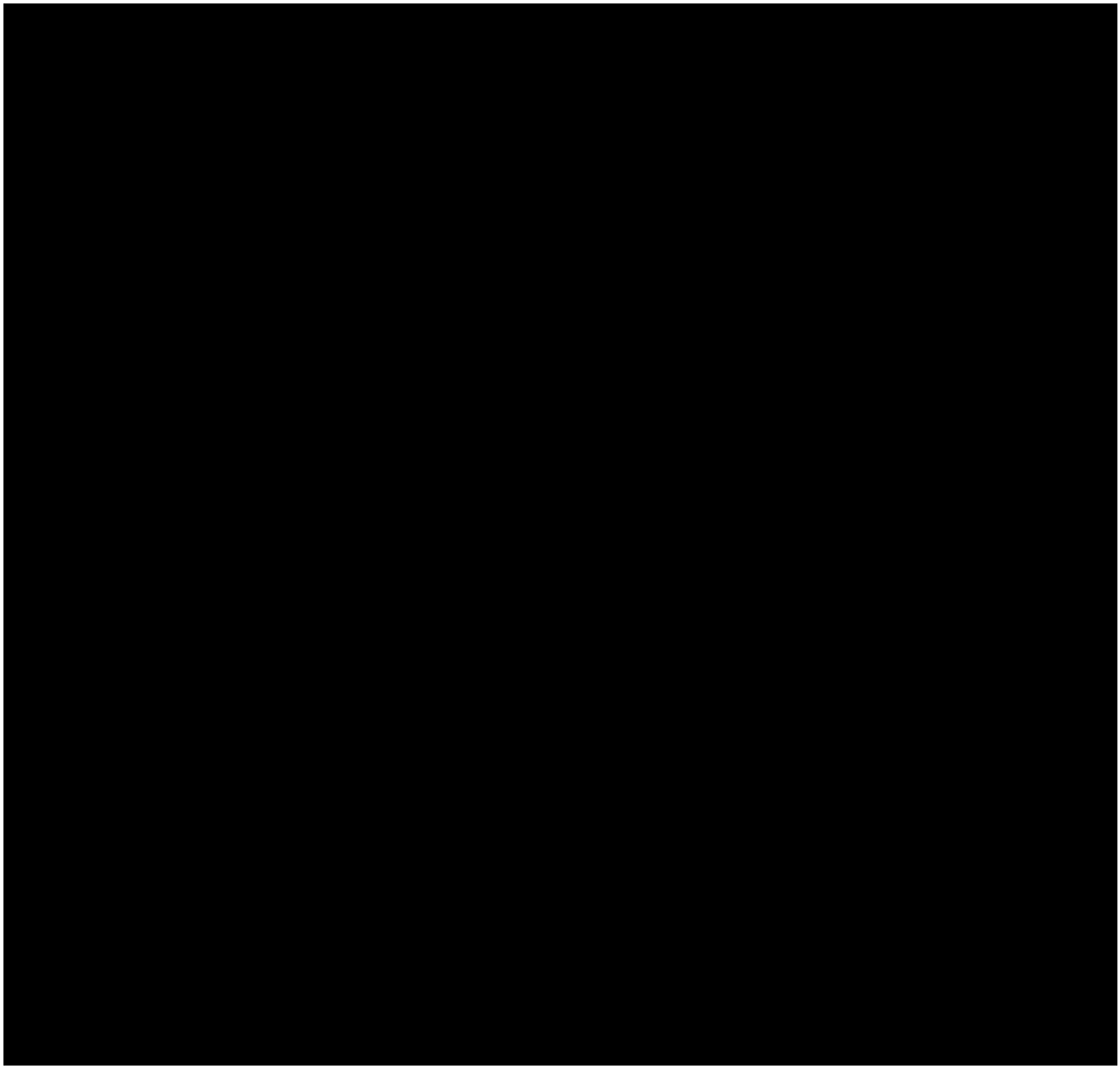


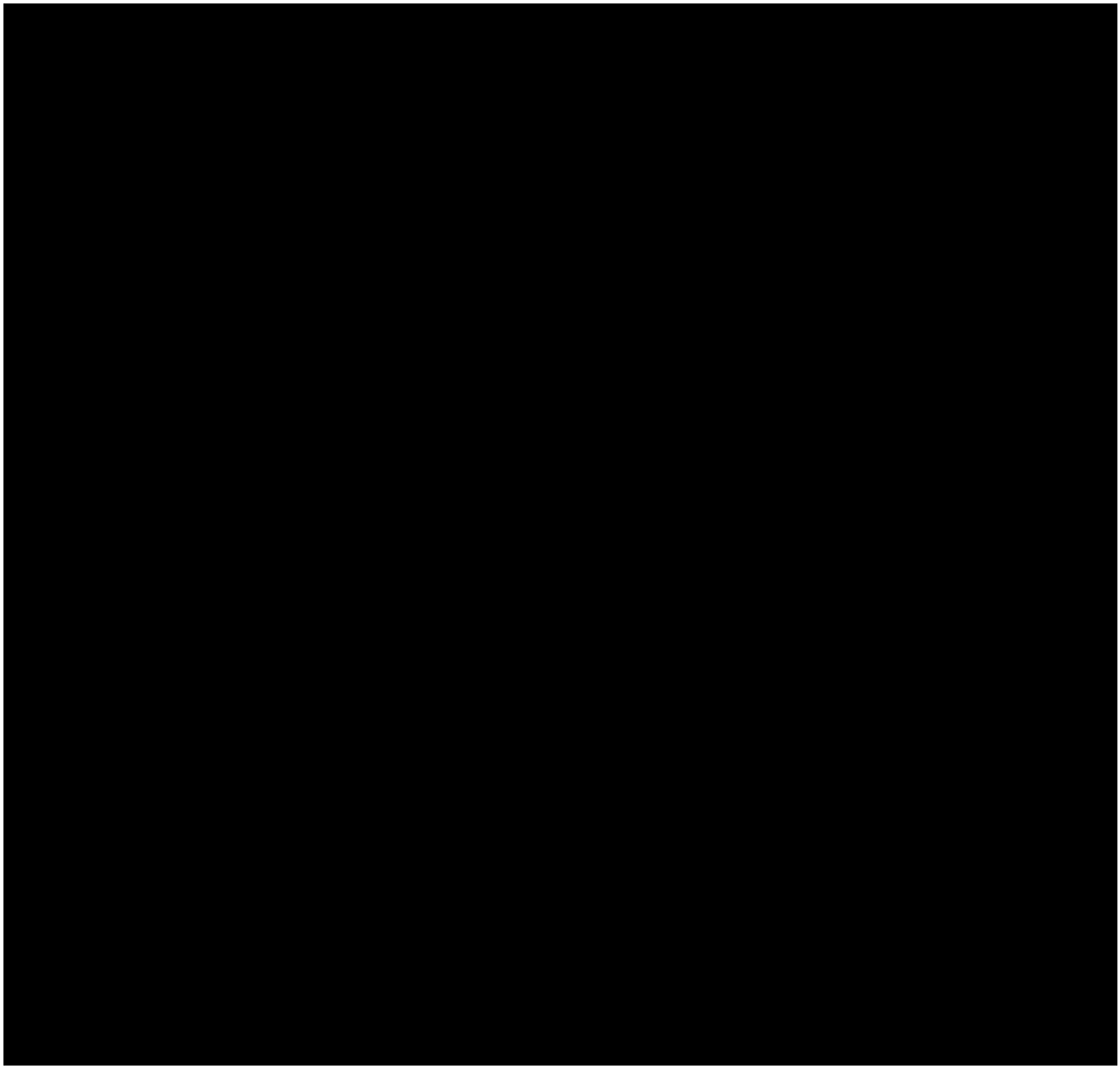


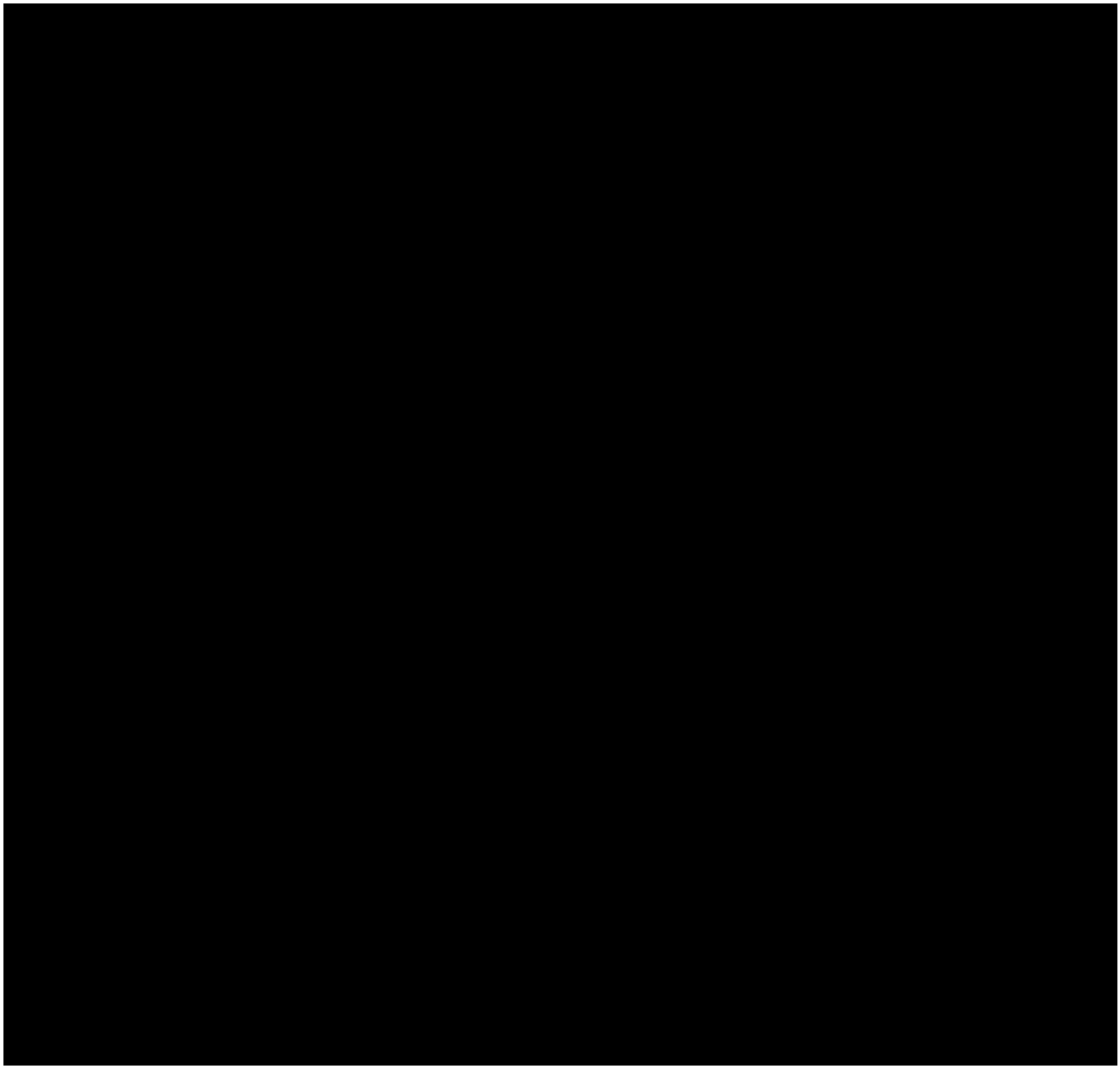


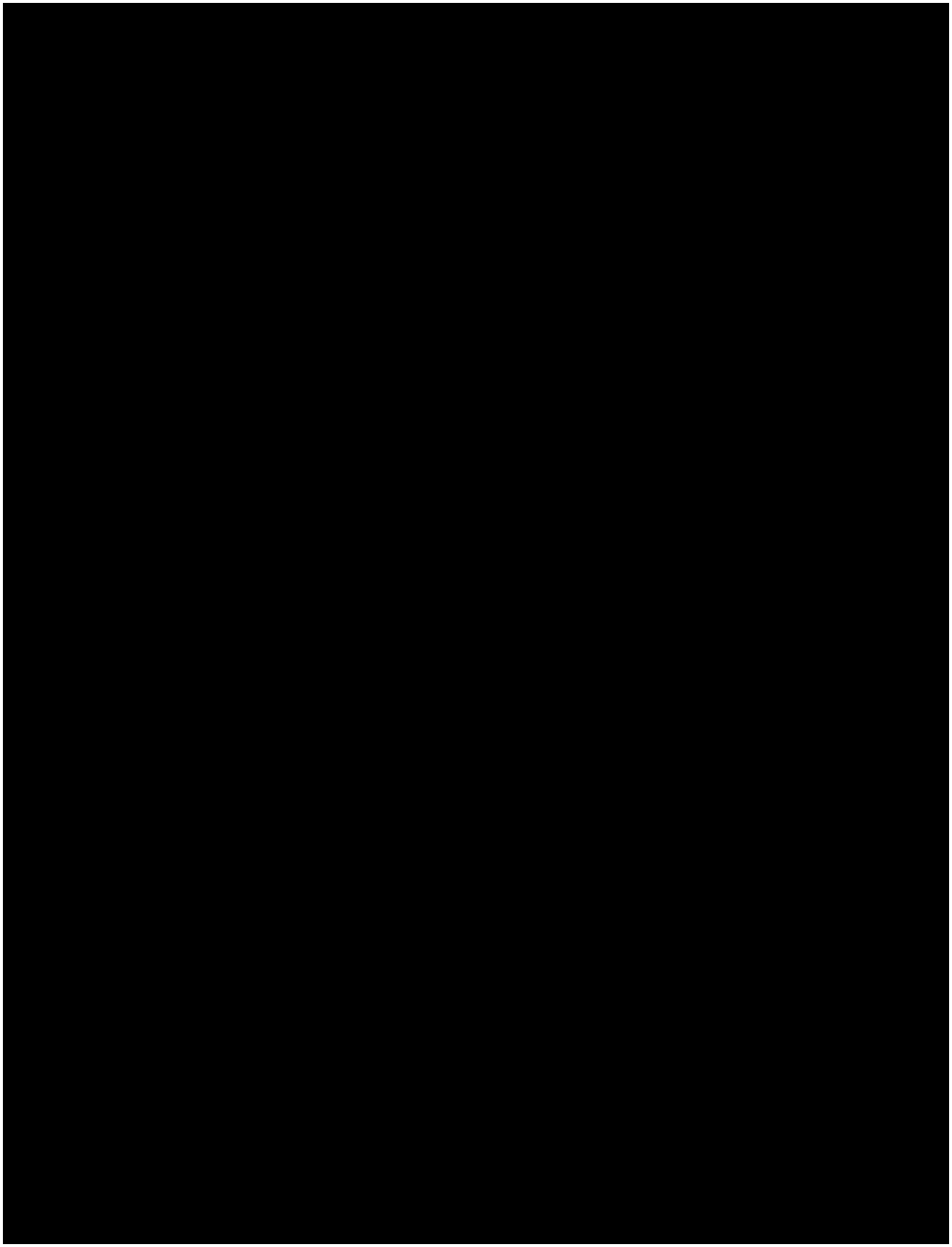


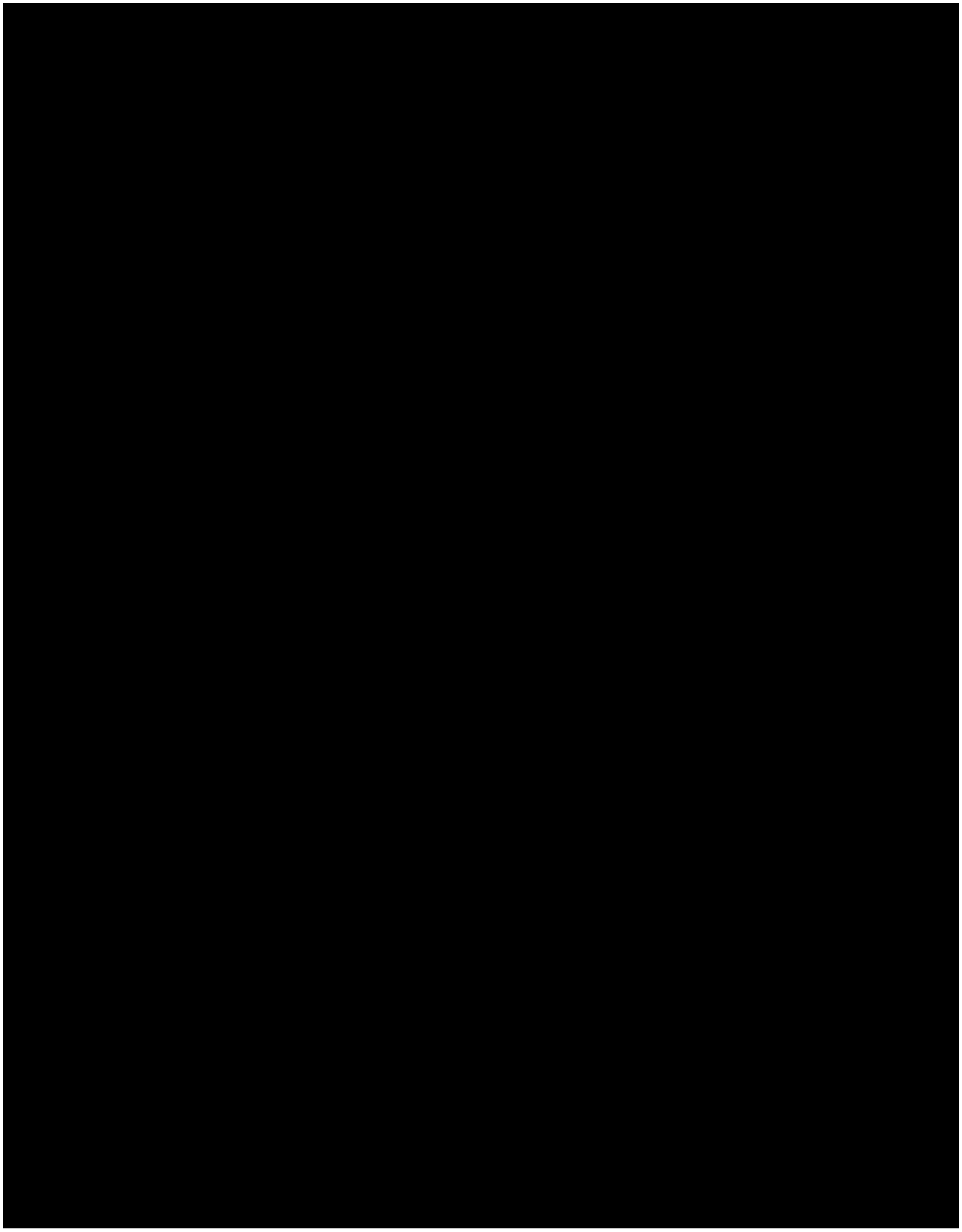


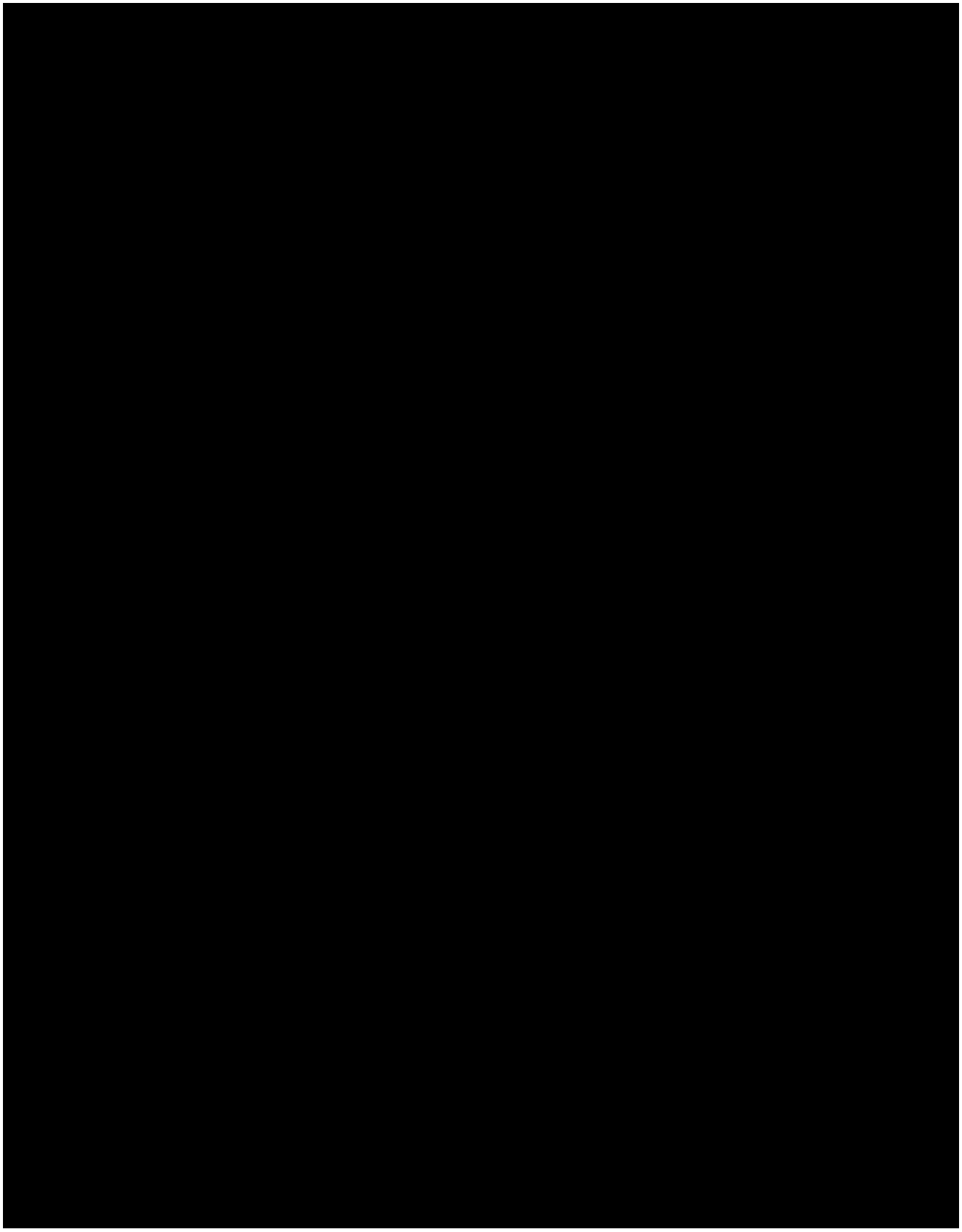


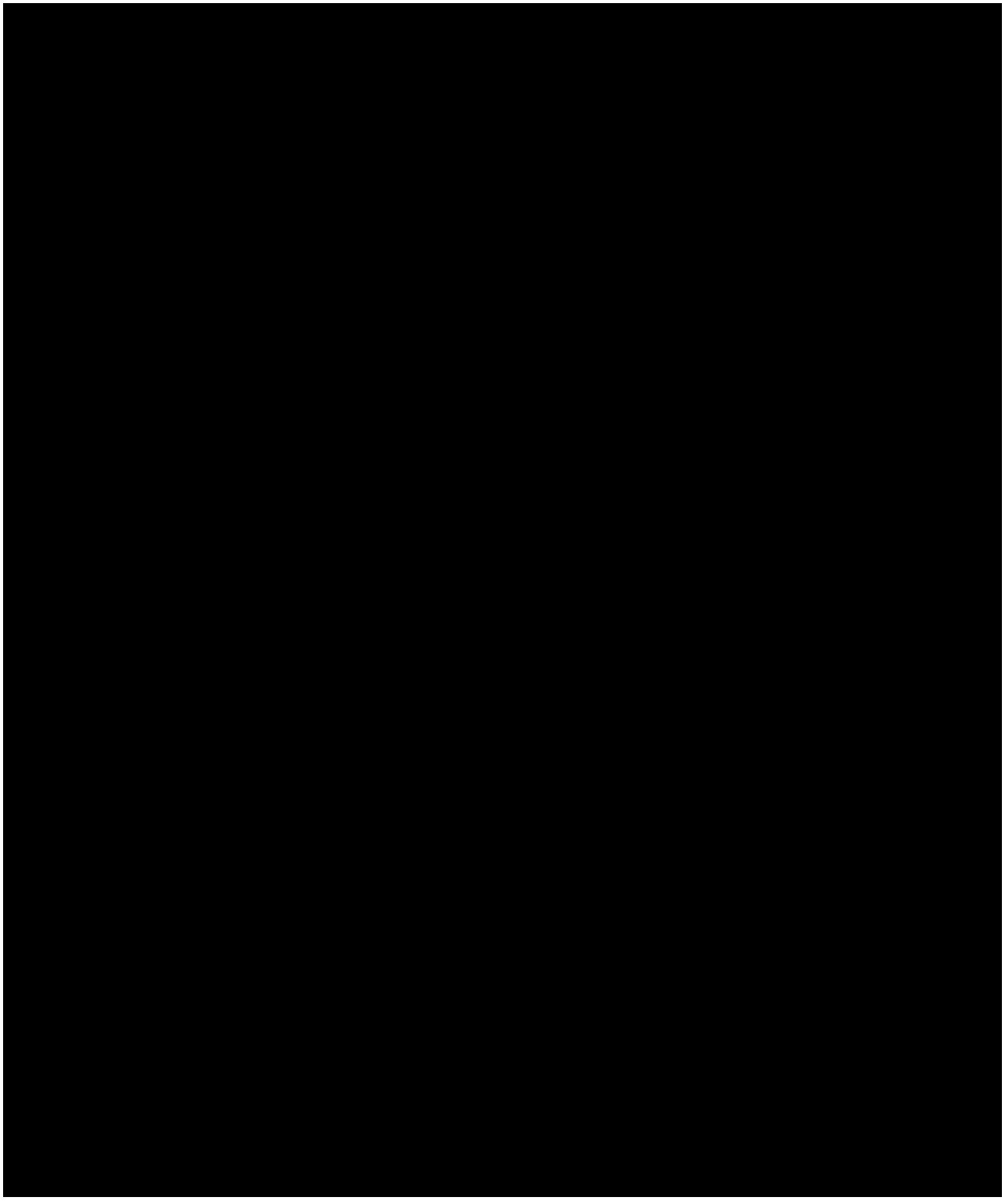


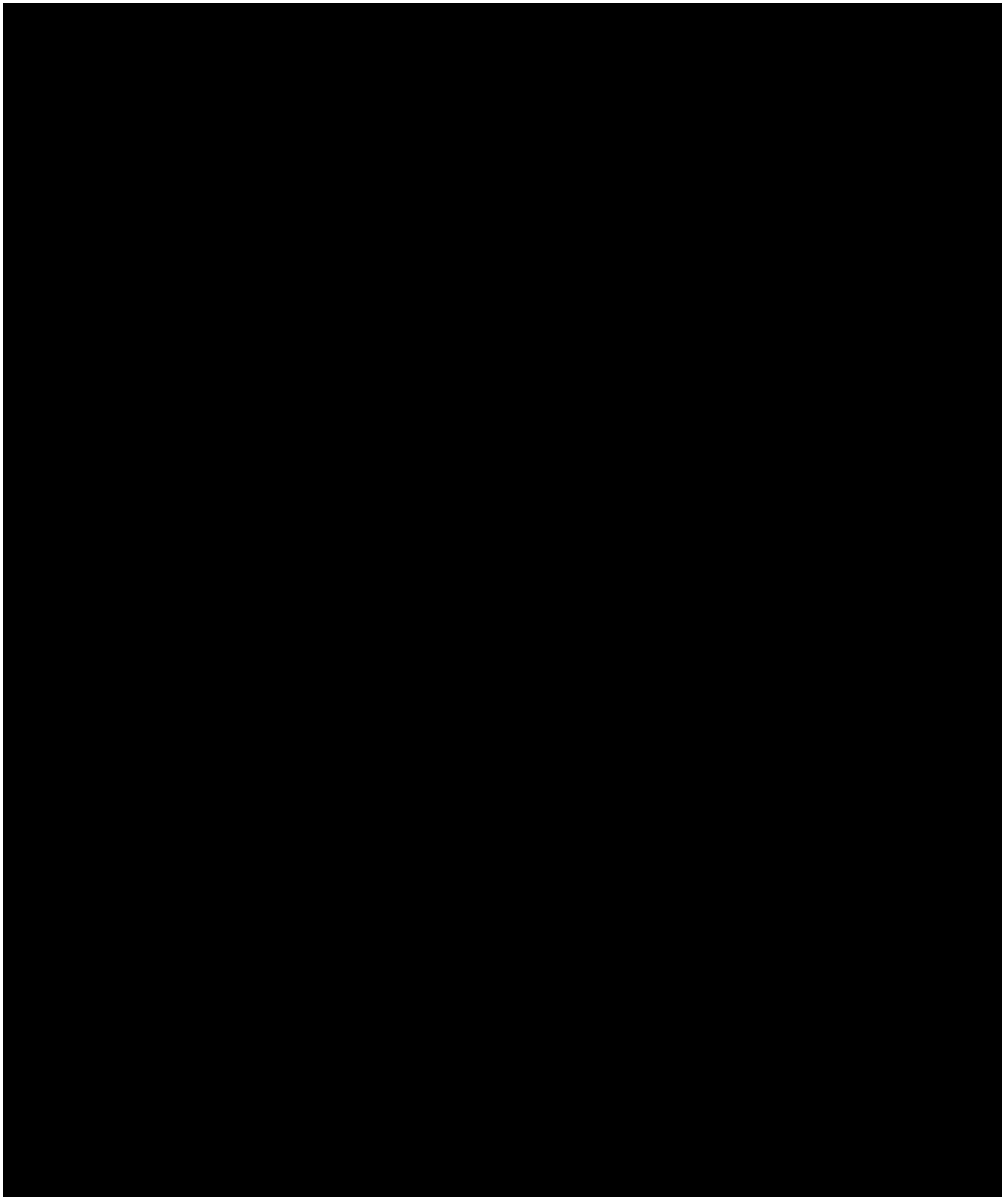


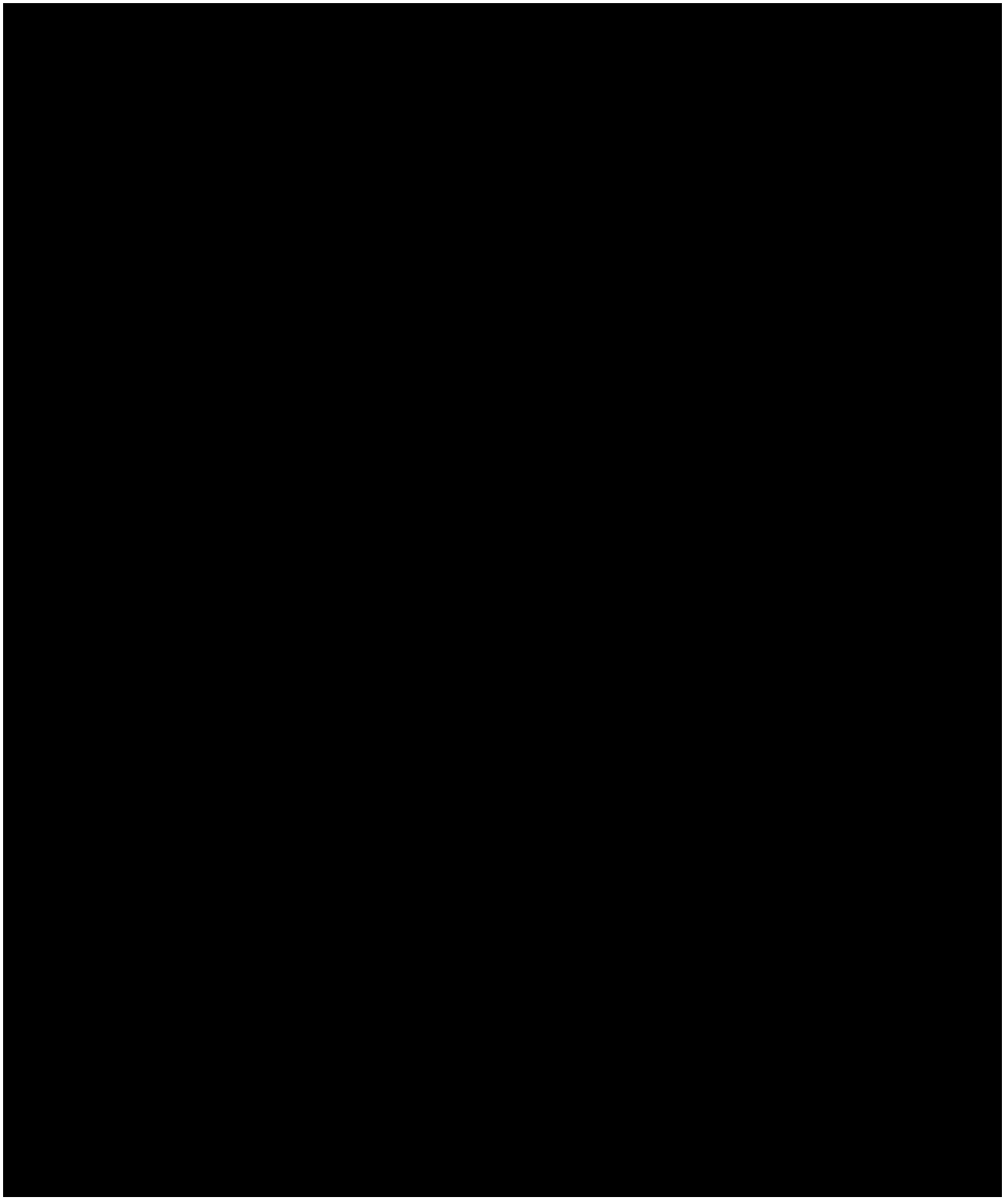


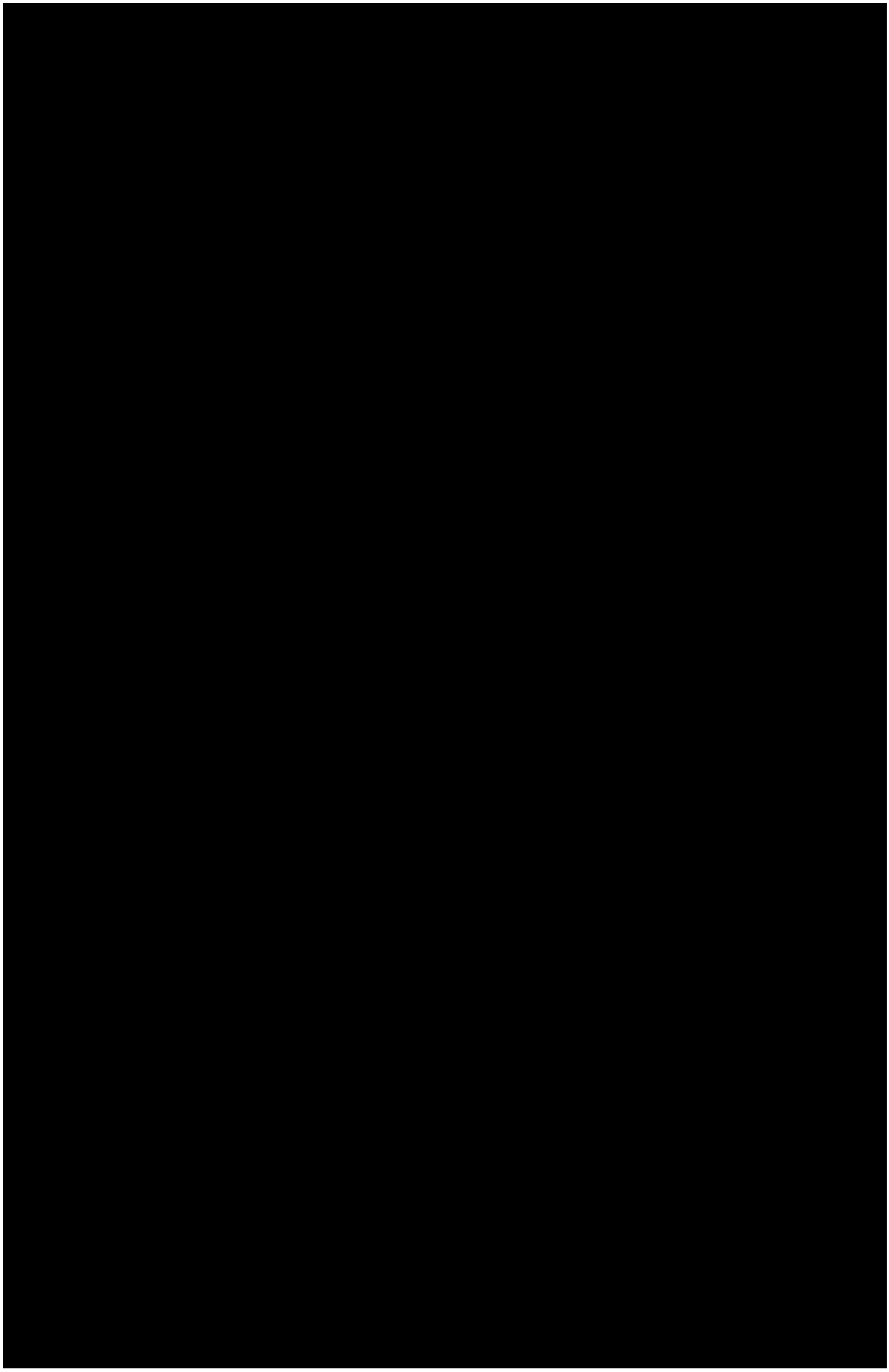


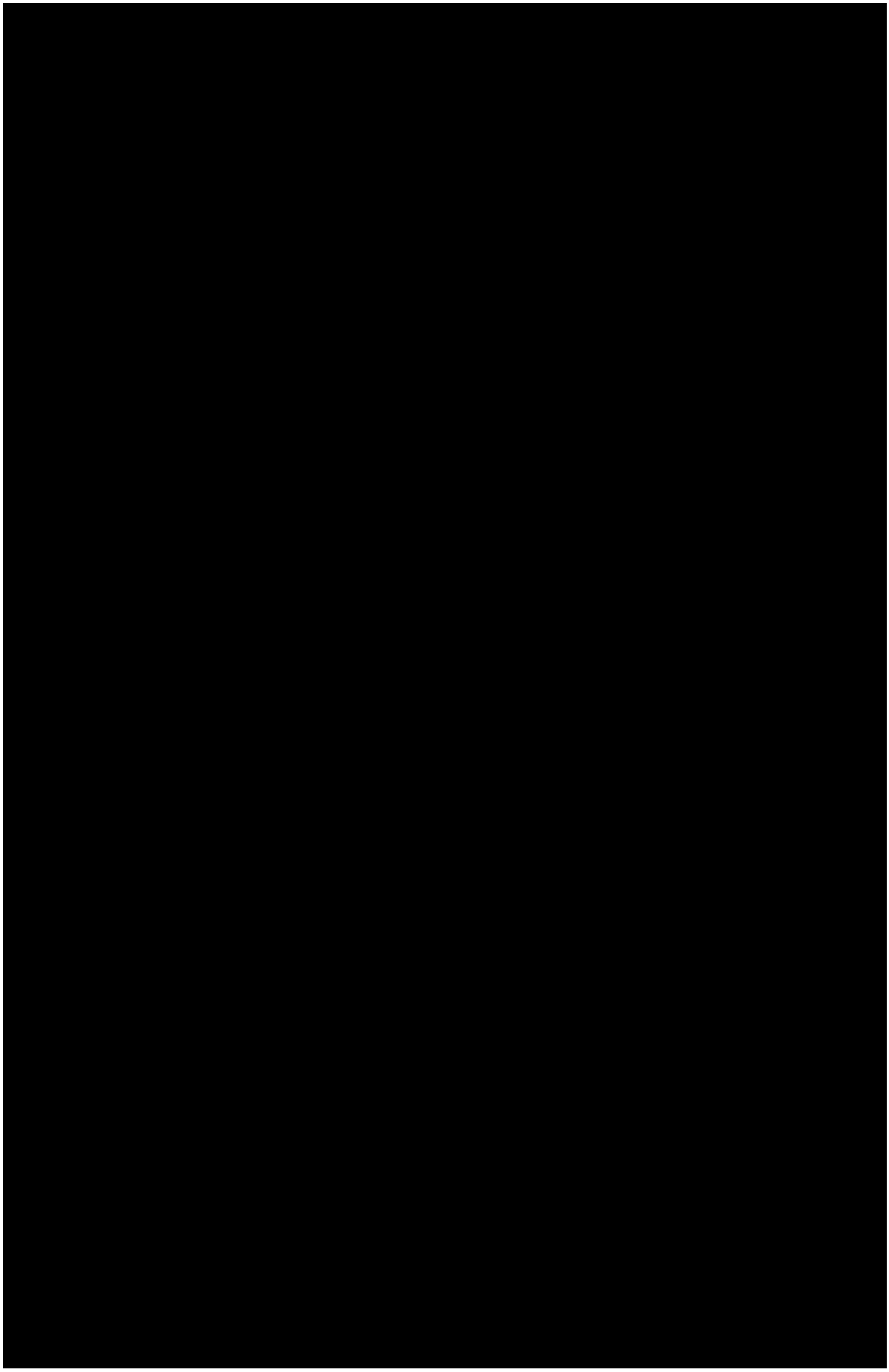


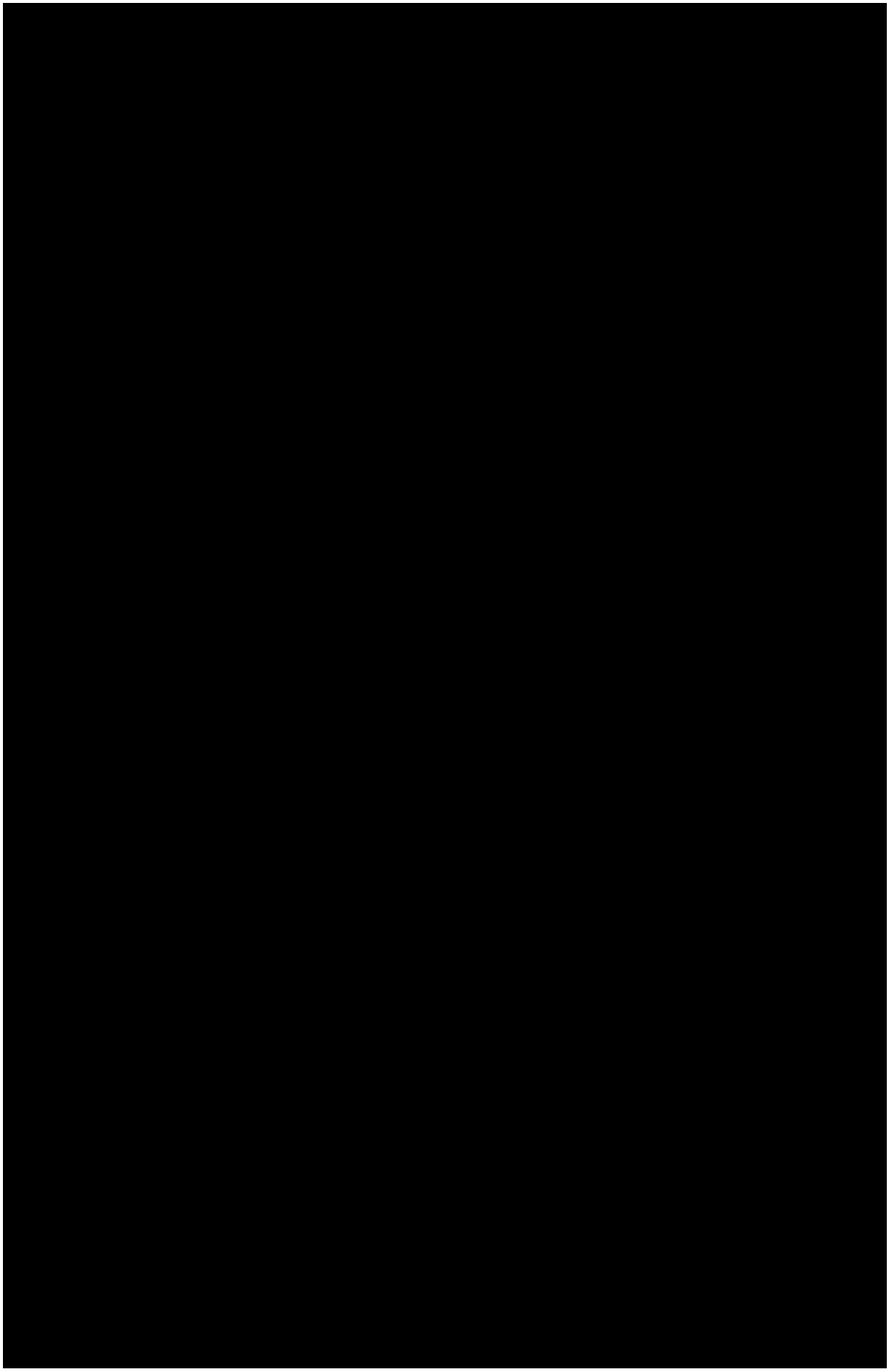


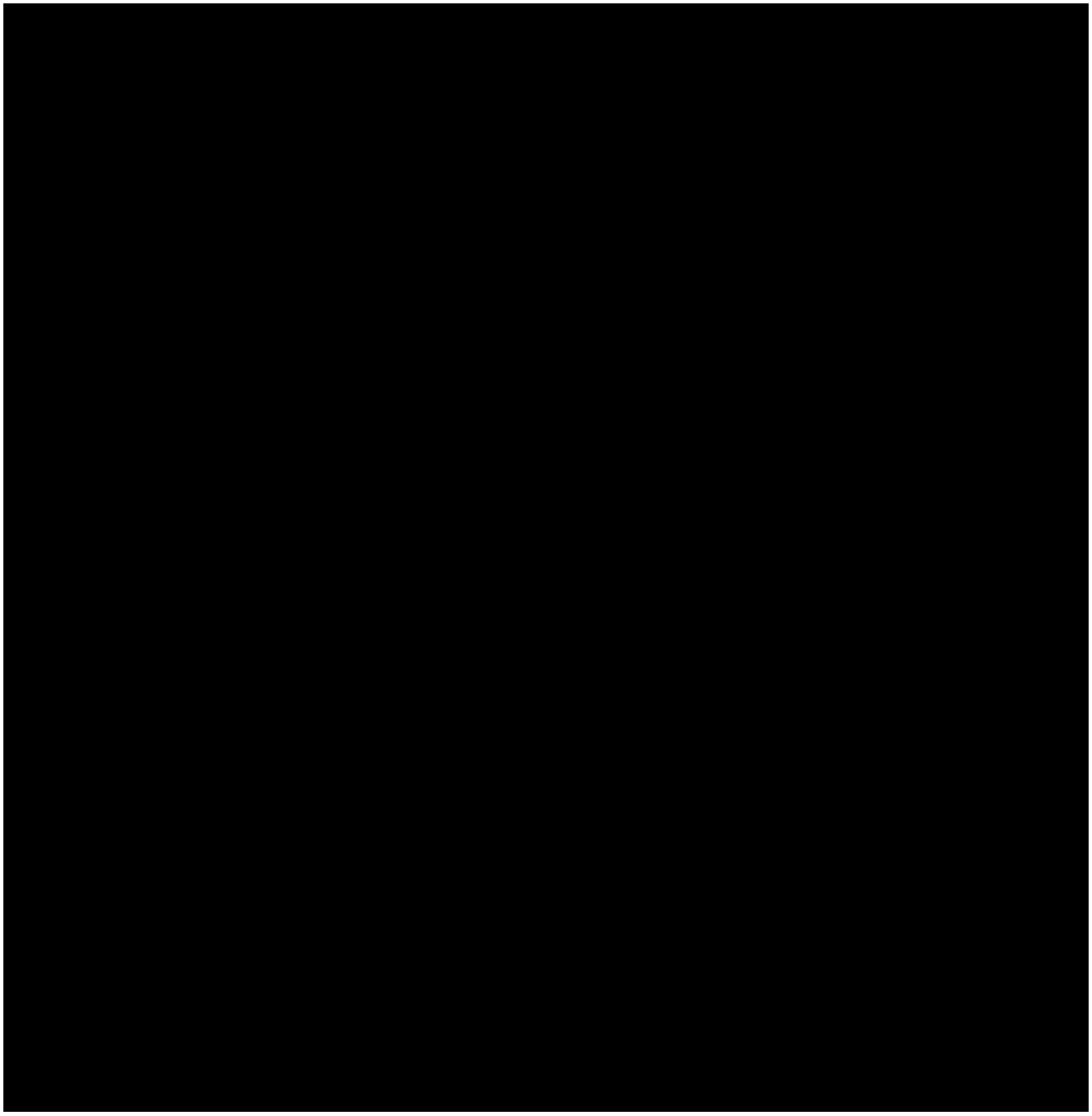












APPENDIX I
Estimation procedures of Totals, Ratios and Sampling Errors

APPENDIX I Estimation Procedures of Totals, Ratios and Sampling Errors

The following formulas were used to estimate total area of land under specific crop and production of specific crop in a stratum.

1. For estimating Total Area of Land under Specific Crop:

$$\hat{A}_h = \sum_{i=1}^{n_h} W_{hi} \sum_{j=1}^{h_{hi}} a_{hij} = \sum_{i=1}^{n_h} W_{hi} a_{hi}$$

in which, $W_{hi} = \frac{M_h H_{hi}}{n_h m_{hi} h_{hi}}$ is the basic weight.

Where:

h represents the stratum

n_h is the total number of sample EAs successfully covered in the h[th] stratum.

M_h is the measure of size of the h[th] stratum as obtained from the sampling frame.

m_{hi} is the measure of size of the i[th] sample EA in the h[th] stratum obtained from the sampling frame.

H_{hi} is the total number of agricultural households of the i[th] sample EA in the h[th] stratum.

h_{hi} is the number of sample agricultural households successfully covered in the i[th] sample EA in the h[th] stratum.

a_{hij} is the value of area for agricultural household j, in the i[th] EA in the h[th] strtatum under a specific crop.

a_{hi} is the sample total area under specific crop for EA i in stratum h

$\hat{A}_h$ estimate of total area under specific crop in stratum h

2. For estimating Total Number of Holders :

$$Y_h = \sum_{i=1}^{n_h} W_{hi} H_{hi}$$

in which, $H_{hi} = a_{hi} * \bar{Y}_{hi}$

Where,

$\overline{Y}_{hi}$ is average yield per square meter of a specific crop in the i[th] EA in the h[th] stratum.

H_h is estimate of total quantity of production of a specific crop in the h[th] stratum.

H_{hi} is estimate of total quantity of production under specific crop for EA i in stratum h.

3. Sampling Variance of Estimates:

Sampling variance for the estimate of stratum total of area, production and yield for a specific crop are estimated by the following formulas.

$$Var(\hat{A}_h) = (1 - f_h)\frac{n_h}{n_h - 1}\sum_{i=1}^{n_h}\left(\hat{A}_{hi} - \frac{\hat{A}_h}{n_h}\right)^2 + f_h\sum_{i=1}^{n_h}(1 - f_{hi})\left(\frac{h_{hi}}{h_{hi} - 1}\right)\sum_{j=1}^{h_{hi}}\left(\hat{A}_{hij} - \frac{\hat{A}_{hi}}{h_{hi}}\right)^2$$

$$Var(\hat{P}_h) = (1 - f_h)\frac{n_h}{n_h - 1}\sum_{i=1}^{n_h}\left(\hat{P}_{hi} - \frac{\hat{P}_h}{n_h}\right)^2 + f_h\sum_{i=1}^{n_h}(1 - f_{hi})\left(\frac{h_{hi}}{h_{hi} - 1}\right)\sum_{j=1}^{h_{hi}}\left(\hat{P}_{hij} - \frac{\hat{P}_{hi}}{h_{hi}}\right)^2$$

Where,

f_h = average first stage probability of selection of EAs within stratum *h*.

$f_{hi} = \frac{h_{hi}}{H_{hi}}$ = average second stage probability of selection within the *i*[th] sample EA in stratum *h*.

$\hat{A}_{hi}, \hat{P}_{hi}$ are weighted total area and production, respectively, of a specific crop in the i[th] EA and h[th] stratum.

$\hat{A}_{hij}, \hat{P}_{hij}$ are weighted values of area and production, respectively, from j[th] agricultural household in the i[th] EA and h[th] stratum under a specific crop.

Since all strata are independent, the total variance at regional and country level is computed by aggregating the result obtained at Zone/Special Wereda level, i.e.

$$Var(\hat{A}) = \sum_{h}^{L} Var(\hat{A}_h), Var(\hat{P}) = \sum_{h}^{L} Var(\hat{P}_h)$$

Where, *L* is the number of strata (Zone/Special Wereda).

In estimating the sampling variance by the above formula, selection of EAs within a stratum is assumed to be with replacement. By so doing the variance estimate may be slightly over estimated but it greatly simplifies the estimation procedure.

5. Coefficient of Variation (CV) of Estimates:

Coefficient of Variation (CV) in percentage of estimate of stratum total of area and production for a specific crop are given by:

$$CV(\hat{A}_h) = \frac{\sqrt{Var(\hat{A}_h)}}{\hat{A}_h} * 100, CV(\hat{P}_h) = \frac{\sqrt{Var(\hat{P}_h)}}{\hat{P}_h} * 100,$$

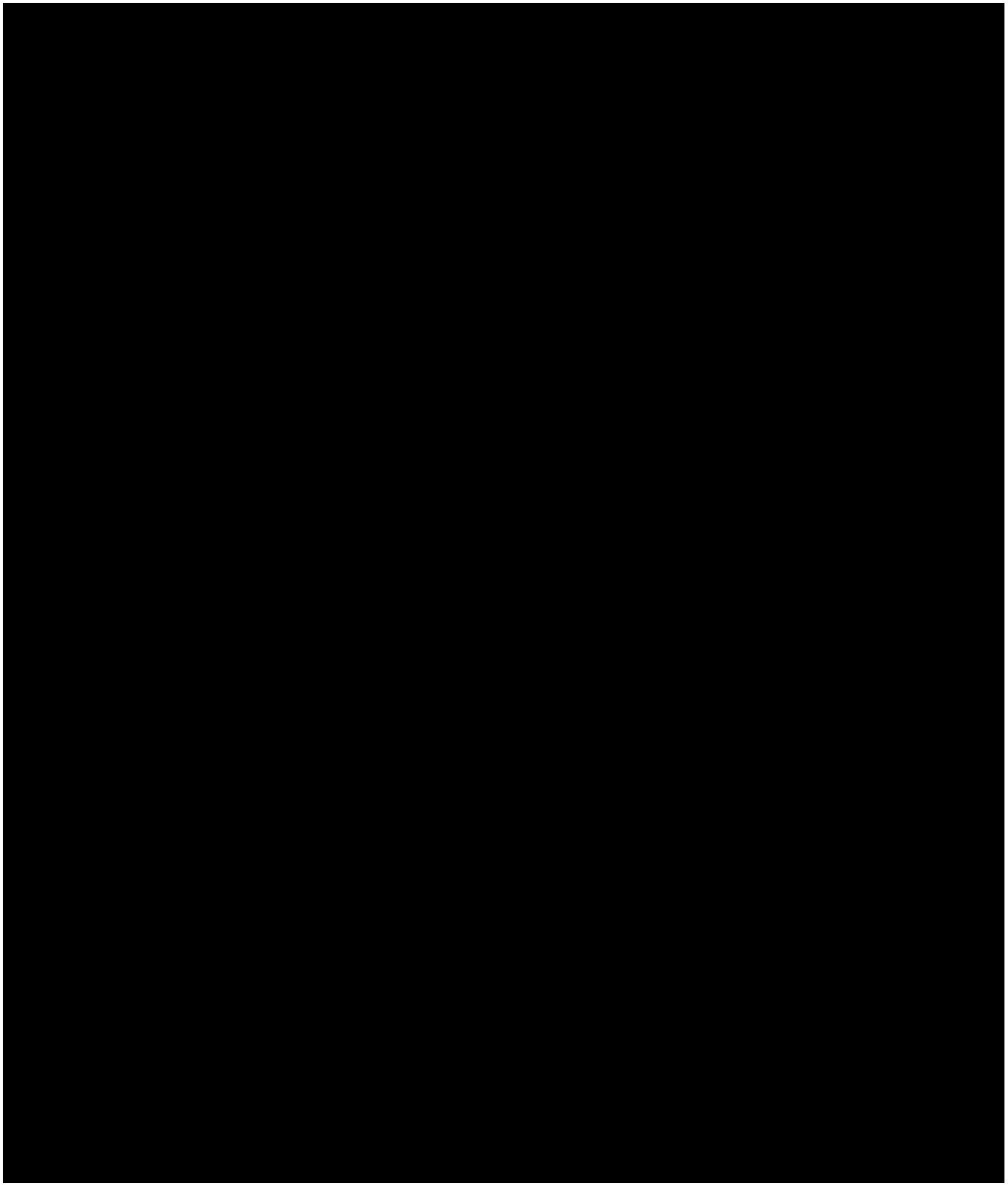
6. Ninety-five percent confidence interval (CI) of stratum total of area:

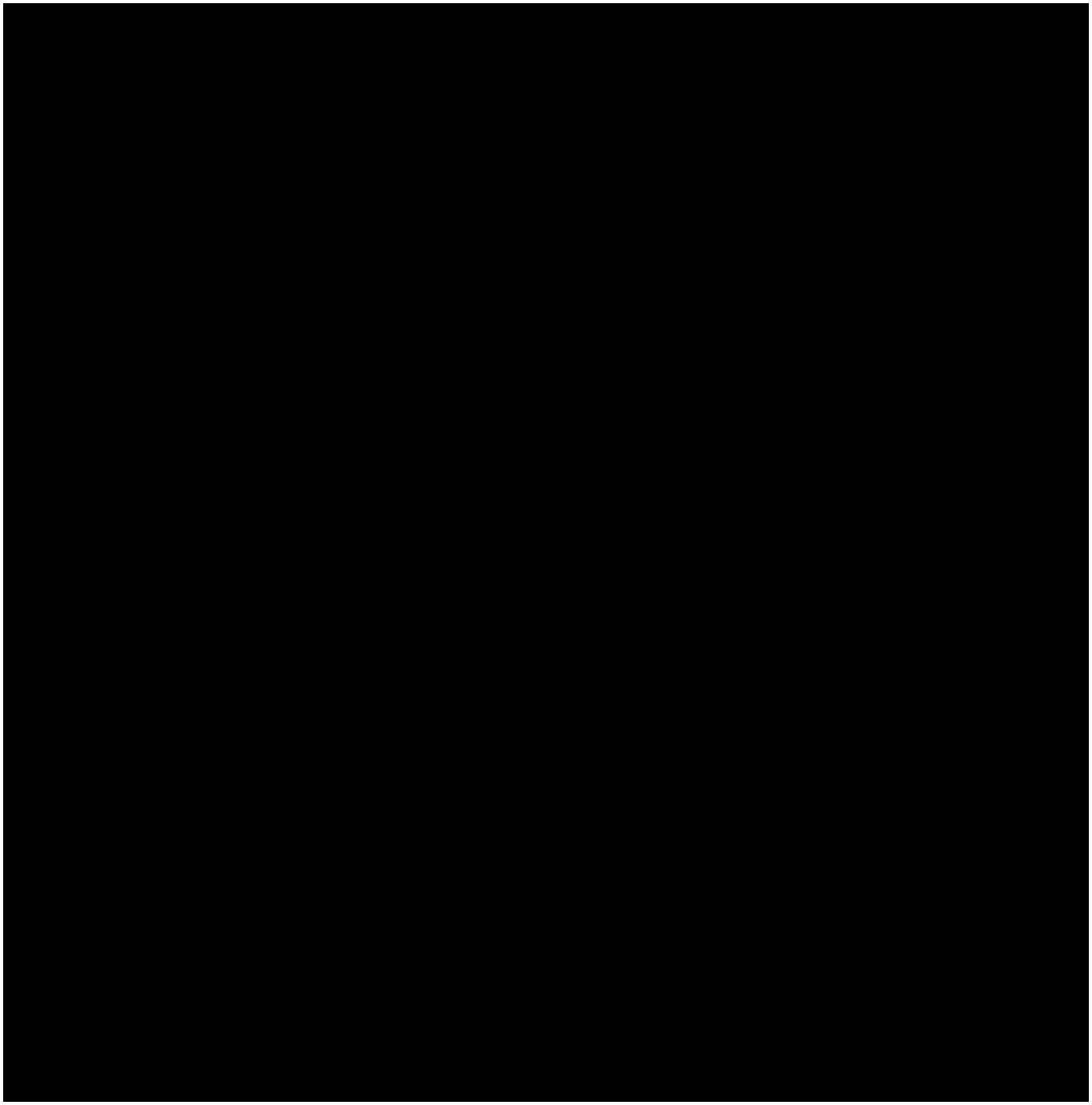
$$\hat{A}_h \pm 1.96 * SE(\hat{A}_h) \quad ,$$

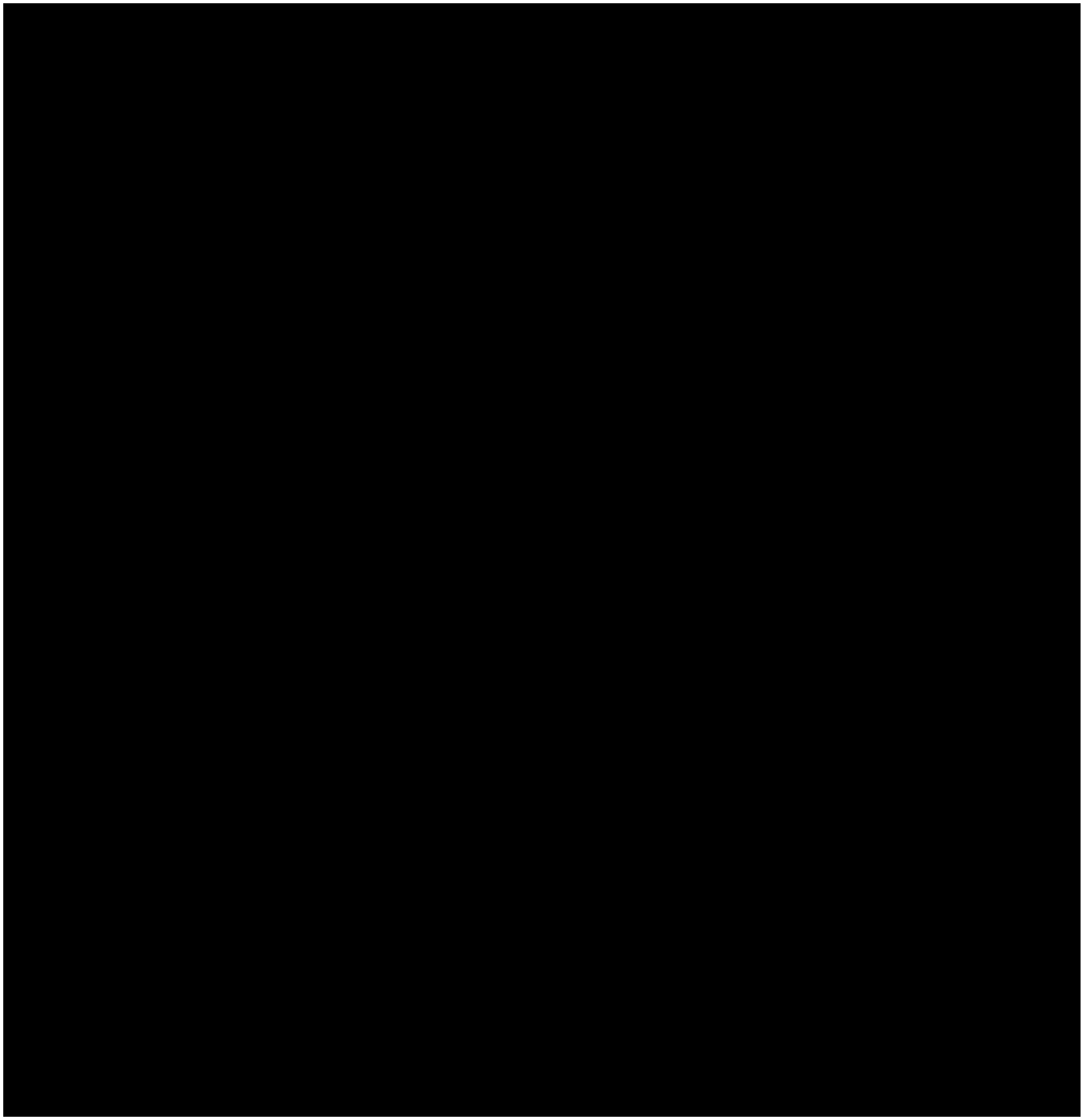
Where $SE(\hat{A}_h) = \sqrt{Var(\hat{A}_h)}$ is standard error of the estimate of the stratum total of area.

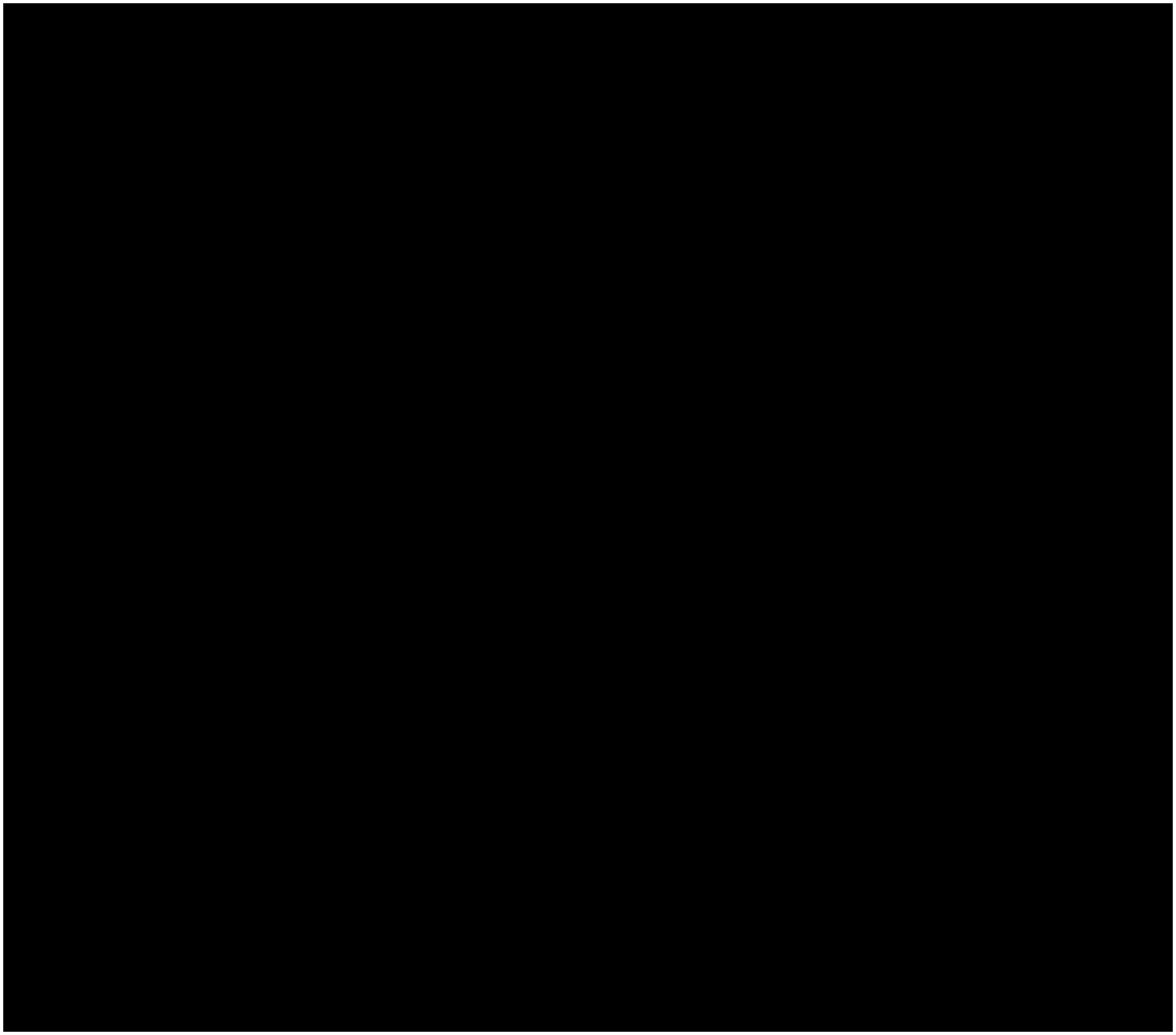
Estimates of standard error and confidence interval for the other estimates can also be calculated by adopting the above formulas.

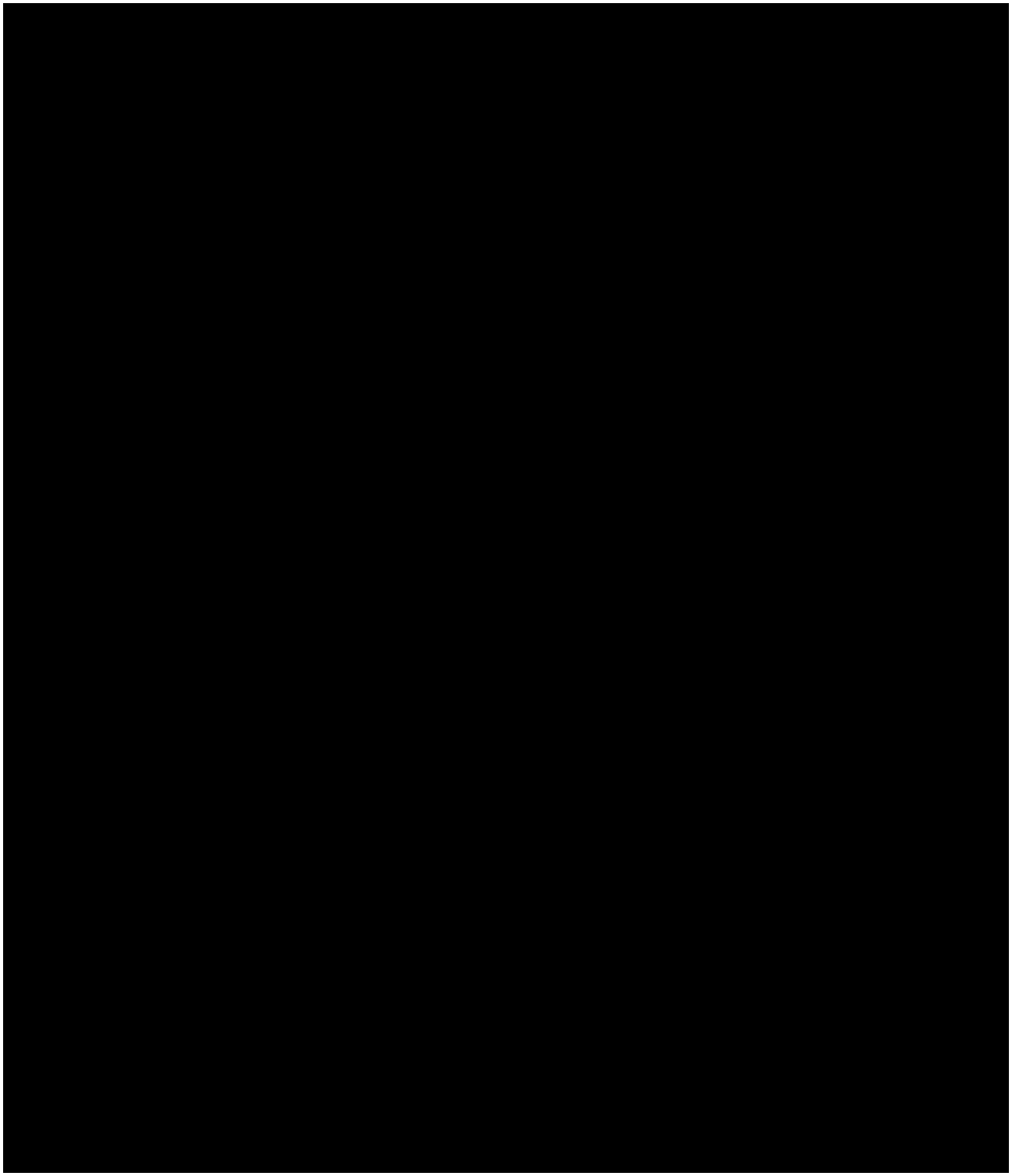
APPENDIX II
Standard Errors and Coefficient of Variation











APPENDIX III
Questionnaires

Form AgSS 2005/8

CENTRAL STATISTICAL AUTHORITY
ETHIOPIAN AGRICULTURAL SAMPLE SURVEY 2012/2013 (2005 E.C)

PART I – IDENTIFICATION PARTICULARS

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Region	Zone	Wereda	PA / REST.AR	EA LOCAL	HH ID	HH HEAD SEX 1=M 2=F	HOLDER ID	HOLDER'S NAME	HOLDER'S AGE	HOLDER'S SEX M=1 F=2	HIGHEST GRADE COMPLETED	HOLDER'S HH SIZE	FARMING TYPE CROP=1 LIVEST=2 BOTH=3

PART II – CROP FIELD / OTHER LAND USE

15		16	17					
			PARCEL NO.		FIELD NO.			
			IS THE FIELD PURE STAND =1 MIXED CROP =2 OTHER LAND USE=3					
			CROP/OTHER NAME		CROP NAME		CROP NAME	
SER. NO.		QUESTIONS FOR THE HOLDER	CODE		CODE		CODE	
0	1	Ownership Own = 1 Rented in =2 Other =3						
0	2	Is field under Extension Program? Yes =1 No = 2						
0	3	Is Field Irrigated? Yes =1 No =2						
0	4	If Field Irrigated source of water. River =1 Lake =2 Pond =3 Harvested water =4 other =5						
0	5	Percent share of mixed crops						
0	6	Crop growing methods 1=by line 2=by broadcasting						
0	7	Seed / Seedling Type Improved Seed = 1 indigenous seed = 2						
0	8	*For Cereals, Pulses & Oilseeds only* Quantity of improved seeds used	Kilo	Gram	Kilo	Gram	Kilo	Gram
0	9	*For Cereals, Pulses & Oilseeds only* Price of improved seeds used	Birr	Cents	Birr	Cents	Birr	Cents
1	0	*For Cereals, Pulses & Oilseeds only* Quantity of indigenous seeds used	Kilo	Gram	Kilo	Gram	Kilo	Gram
1	1	Was crop damaged? Yes = 1 No =2						
1	2	If yes in question number 10, Cause of damage → Code →						
1	3	Percent of damaged crop						
1	4	Prevention/precaution measure taken? Yes =1 No =2						
1	5	Type of measure if any? Chemical = 1						

		Non – chemical = 2 Both = 3									
1	6	Chemical type used if any. Pesticide =1 herbicide =2 Fungicide =3 1&2 = 4 1 & 3 = 5 2 & 3 = 6 All = 7									
1	7	Is Fertilizer Used? Yes =1 No = 2									
1	8	Type of fertilizer used if any? Natural = 1 Chemical = 2 Both = 3									
1	9	If chemical fertilizer used 18.1 Type UREA = 1 DAP = 2 Both = 3									
						Kilo			Gram		
		18.2 Quantity of chemical fertilizer used									
2	0	If natural fertilizer used, type Manure = 1 Compost = 2 Organic = 3 1 &2 = 4 1&3 = 5 2 & 3 = 6 All = 7 others = 8									
2	1	Quantity of crop produced in standard/local measurement	Name	Code	Quantity	Name	code	Quantity	Name	Code	Quantity

PART 3A: RESULTS OF AREA MEASUREMENTS using GPS

18	19	20	21	22	23	24	25
GPS Accuracy during field measurement	Is the field measured? yes =1 No =2						
	Area of measured field		**Is the field** **Flat =1** **Partialy Sloppy = 2** **Sloppy = 3**	**Code**	**If the field covered?** **None , 1** **With plant / permanent crop = 2** **With house = 3** **Partially covered , 4** **Others , 5**	**Code**	**Comments**
	Area in square meters **(Clockwise)**	Area in square meters **(Anti-Clockwise)**					
Field measurement			***Date***		***Month***		

PART 3B : RESULTS OF AREA MEASUREMENTS USING COMPASS-ROPE

18	19	20	21	22	23	24	25	26
Is the field measured?		Yes =1		No = 2		Code		
Side	1 - 2	2 - 3	3 -	4 -	5 -	6 -	7 -	8 -
Bearing (0)								

Length								
Side	9 -	10 -	11 -	12 -	13 -	14 -	15 -	16 -
Bearing(0)								
Length								
Side	17 -	18 -	19 -	20 -	21 -	22 -	23 -	24 -
Bearing (0)								
Length								
Side	25 -	26 -	27 -	28 -	29 -	30 -	31 -	32 -
Bearing (0)								
Length								
Field Measurement	date	month	**Closure error**		Area in square meters			

	Name	**Signature**	**Date**
Data collector			
Field Supervisor			